The Use and Abuse of Pesticides: its Impact on Human Health and Ecology

(An ethnographic study in District *Larkana*, Sindh)

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FORMAL DECLARATION

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Final Approval of Thesis

This is to certify that we have read the thesis submitted by Mr. Gulzar Ali. It is our judgment that this thesis is of sufficient standard to warrant its acceptance by the Quaid-i-Azam University. Islamabad for the award of the Degree of M. Phil in Anthropology.

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ABSTRACT

In agriculture sector of *Larkana*, chemical pesticides has increasingly adopted. Pesticides are used to control pests and insects which attack on crops to harm them. The main objectives of the study is to provide detail understanding of farmers' opinion and perception about the use of chemical pesticides. This research also examines the impact of chemical pesticides on farmer's health and environment.

The research sample includes thirty farmers who use chemical pesticides. Qualitative research methods such as participant observation, interviews and case study method were used to conduct the research.

The analysis of the research findings elucidates that farmers prefer the use of chemical pesticides due to its positive impact on crop productivity. Farmers believing that pesticides having both positive and negative effects to some extent have largely positive perception about their use. They are not well acquainted with the protective measures while using pesticides. The application of pesticides cause minor health inconvenience to serious health hazards to farmers including cancer, skin burn and neurological effects. The few death cases due to pesticides are also reported. Besides their impact on farmer's health, chemical pesticides contaminate soil, surface and ground water, endanger eco-friendly insects, animals, therefore, misbalance ecology.

Key words: *Agriculture, Pesticide, Health, Perception, Ecology*

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Chapter 1

INTRODUCTION

Pesticides is a substance or mixture of substances which use to destroy, prevent and reduce the pest including damage caused by the pest. Pests are the living organisms which cause damage to animal, human, and crops. Pesticides contains a huge category of substances including herbicides, rodenticides, insecticides and fumigants to prevent the crops from the attack of insects such as cockroaches, rodents like mice, pests and other unwanted plants and weeds. In agricultural and public health, pesticides plays an important role. Residentially, they are used by farmers to protect the crops from insects and rodents as they can cause damage to the crop in the form of disease (Lubomir I, Fliur, & Biana, 2013).

Pesticides has both positive and negatives impacts. The excessive use of pesticides have major drawbacks for ecosystem. It effects human and environment including other various species of the organisms. There is certain function of ecosystem, each of the things have relation with one another somehow. It is a process of ecosystem that if one part of system is not working sufficiently then it has impacts on whole system of the ecosystem. Similarly, if pesticides are used for the prevention, control or to reduce the pest then it has negative impacts too (Panuwet, Siriwong, Prapamontol, & Fiedler, 2012).

Several researches on pesticides has concentrated into the main areas including the impact of pesticides on humans, fauna and flora and water contamination. Different types of chemical pesticides have environmental impacts, the accuracy of machinery and environmental conditions such as weather. Pesticide exposure can take place through respiration, skin contact, eye and intestinal tract depending on the dose, the types of chemical composition and the health of the person. It can also occur in the form of contaminated water and food and utensils (Skinner, Lewis, Bardon, & Tucker, 1997).

Globally, more than 1.8 billion people use pesticide to maximize crop yield and control pest attack. According to World Health Organization (2020), several million cases of occupational pesticides poisoning were reported from all continents which provided evidence that the use of pesticide has adverse effects on human health. In America, the

Health and Safety department has reported 196 incidents of pesticides poisoning including agricultural workers and public. According to a recent report by Food and Agricultural Organization (2000) from Pesticide Action Network (PAN), three million people are poisoned through chemical pesticides and two million die each year. The largest number of deaths are in developing countries (Wilson & Tisdell, 2001).

The lack of proper knowledge of precautionary measure is the source of risk for health as less information of user is main issue that leads to contaminate the environment as soil contamination, air humidity and water pollution. Although several factors contribute to negative health and environmental consequences from the farmer end unintended uses of pesticides such as lack of the enforcement of the legalization, absence of legislation and weak of the management of the pesticides (Hassaan & Nemr, 2020).

According to environmental protection agency, pesticides are manufactured to kill pests and insects hence they are toxic to human and animals. The health and agricultural experts has categorized the effects of pesticides as topical or systematic. The burning of skin and inflammation are the most common topical symptoms whereas coughing, sneezing and poisoning are the systematic symptoms of pesticides (Raanan, Harley, & Balmes, 2015).

On contrary, the systematic poisoning symptoms are difficult to understand as they occur after a long exposure to the pesticides. It includes nausea, headache, cancer, heart failure and death. The brief exposure to the pesticide can cause short time pesticide poisoning. The short time poisoning occur through skin, inhalation, eye, or orally, also increased risk of brain cancer, breast cancer, kindly cancer and lungs cancer (Hildebrandt, Guillamon, Lacorte, & Tauler, 2008).

Pakistan being an agricultural country has a major agriculture sector on which economy is dependent. In rural areas of Pakistan, 42.5 percent people are involved in agricultural activities in which chemical method of pest control is prominent to increase crop productivity. In most developing countries including Pakistan, the use of pesticides have increased by 9% or more per hectare (Bakhtawer & Afsheen, 2021).

In Pakistan, pesticide utilization has started in 1954 and is currently on the rise. Insecticide has shared major portion among the total pesticides. In Punjab Province, high percentage

of pesticides is used followed by other provinces including Sindh, KPK and Baluchistan. Pesticides are mostly applied on cotton crop almost 70-80% of total use. Other crops including wheat, maize, rice, vegetables, sugarcane and fruits are also under pesticide utilization. In different area of Pakistan, mainly the residues of organochlorine have been reported in soils and water (Shahid , Ahmad, & Khalid, 2016).

1.1 The Problem

In district *Larkana* of Sindh, it has been observed that farmers mostly rely on pesticides to protect their crops from pest's attacks without knowing the harmful consequences of chemical products. Soil of Sindh is facing acute shortage of organic matter since last couple of years as for major crops farmers use pesticides for high yield. No proper mechanism is being observed for careful use of the chemicals. This practice leads not only to development of resistance in pests but also reduce the number of useful insects, outbreak of secondary pests, health issues and environmental pollution. Therefore, this research aims at exploring the impacts of inorganic pesticides on human health and environment.

1.2 Statement of the Problem

Regardless of the considerable varieties of pesticides used in agriculture for protecting the crop also collecting maximum benefits from the field, due to usage of pesticides a farmer gets much yields in minimum time period. The use of pesticides also have impacts on human health including ecology. There are many other sides effects of the pesticides, the excessive use of the pesticides effect soil power and effect many species. The misuse of the pesticides is due to insufficient knowledge of usage of the dose of drug at a time. Keeping in this view the use and abuse of pesticides is more dangerous for the growers and consumer, this research explores the impacts of pesticides on health and ecology and brings light on socio-economic domain of farmers using inorganic agricultural product for cultivation and food production.

1.2.1 Operationalization of Key terms

1.2.1.1 Pesticides

The term pesticide includes a variety of plant growth regulators including insecticides, herbicides and fungicides. These are used to control several plant diseases and pests such as ticks, mosquitoes, worms and rats. In agriculture, pesticides are significant for insect infestation and weed control (Akhtar, Sengupta, & Chowdhury, 2009).

In present research, the term pesticide refers to all the types of chemical or inorganic substance used for pest control in agricultural areas of Larkana.

1.2.1.2 Health

Health is the absence of frailty and disease with a state of complete social, physical and mental well-being. A condition in which an individual is able to perform personal and family valued work due to physical and psychological strength. It is a state in which community roles can be easily fulfilled and achieved and to deal with all kind of social, environmental, biological and physical stress while adjusting or coping with change. Health is not merely the object of living rather is a part of everyday life. It determines physical capacities, social and personal resources being a positive concept (Svalastog, Donev, Kristoffersen, & Gajovic, 2017, p. 431).

In this research, the term health refers to physical health of farmers who use pesticides. The indicators for measuring health in this research is physical and neurological diseases occurrence level as well as the mortality cases in research area due to pesticide usage.

1.2.1.3 Perception

The word perception originates from the Latin word “perceptio” which means receiving, collecting and comprehending with the help of senses. Perception is the way in which people think or understand about something with the help of sensory information. It is the ability to understand and become aware of things (Qiong, 2017).

In present research, the perception is measured through indicators such as the views, beliefs and understanding of farmers about inorganic pesticides.

1.2.1.4 Ecology

Ecology is defined as the relationship between humans with their physical environment. The relationship exists at either individual or community level. Ecology can also be refers as ecosystem which includes whole environment including physical surroundings and other living organism (Oh, Heo, & Lee, 2021).

In this study, the indicators of ecology is the components of physical environment including soil, water and animals.

1.3 Research Objectives

Every research has some aims, objectives, and goals which keep the research on track. The present study was attempted to examine the phenomenon of pesticides. The impact on the human health and ecology is also included. The following are the main objectives of this research.

1. To determine the extent of pesticide use in research area.
2. To know the perception of farmers about pesticide consumption.
3. To record the effects on the ecology due to chemical pesticides use in agriculture.
4. To explore the impacts of in-organic agricultural materials on health.

1.4 Research Questions

1. To determine the extent of pesticide use in research area.

- What are the types of pest control methods used in locale?
- Why farmers prefer the use of chemical pesticide?
- How pesticides are applied in field?

2. To know the perception of farmers about pesticide consumption.

- How the perception of the farmer about inorganic pesticides develops?
- What are the major determinants behind the perception of farmers?
- What is the relationship between the perception of farmers and pesticide usage?

3. To record the effects on the human ecology due to pesticides use in agriculture.

- What factors of the ecosystem are effected by pesticides?
- What are the impacts of pesticides on animals?
- How pesticides effect fertile land and water?

4. To explore the impacts of in-organic agriculture materials on health.

- How farmers are exposed to pesticides?
- How pesticide application is associated with human health?
- What are the different physical and neurological diseases caused by pesticides?

1.5 Hypothesis

The use of pesticides has negative impacts on human health i.e. farmers and ecological factors including animals, soil and water.

1.6 Rationale of Study

In agriculture sector of Larkana, there has been issues of crop loss and low production due to pests and insect attack. Farmers were dissatisfied with traditional methods of crop production. To combat pest attack and increase crop yield, they have been using chemical pesticides for few years. Although, there are several benefits of pesticides for farmer, there have been many concerns associated with them. Pesticides are mobile in environment and move through water, air and soil which harm farmers as well as cause death due to poisoning. In research area, the farmers and environment are the key variables getting effected by pesticides with least awareness. Therefore, I proposed to study the impacts of chemical pesticides on farmers' health and environment.

1.7 Significance of Study

As the study is anthropological and has scrutinized the issue more deeply, so it can be utilized to understand the usage of pesticides and availability of the legal management of pesticides. It will reveal the structure of political economy in rotation of pesticides and to inform peasant about the pros and cons of the toxically substance. This study is a kind of awareness towards the small farmers for safety of health and environment so that the farmers reduce the amount of the pesticide's usage in field.

It gives a bird's eye view of the international standard of the pesticides including legal procedure of the selling pesticides. In the context of Pakistan, it a contribution in literature showing the impacts of inorganic agriculture on public health, human ecology and the socio-economic factor of contribution to reduce the danger of environment and health in Pakistani society.

1.8 Theoretical Framework

1.8.1 Neo-liberalism

It is an ideology and policy model which refers to free market economy and transferring economy power to private sector. Based on the principals of neoclassical economics, it recommends limitations on government subsidies, increase in tax open market and capital with least perfectionism. It has been used since the beginning of twentieth century by different scholars. It resembles the lassies-faire economic liberalism (Stahl, 2021).

Over twenty five years, neoliberalism has gained traction. It is originated from liberalism with a new kind of liberal ideology. It became prominent in 1776 when a Scottish economist Adam Smith wrote a book "The wealth of nations". This book concluded the idea of free trade and getting rid of government intervention in economic matters. During 1930s, an economist named John Keyes challenged the proposition of liberalism and referred this notion as suitable for capitalists (Flew, 2014).

Later during 1970s, some economists advocate for liberalism due to increase public debt and economic stagnation. Neoliberalism is the revived form of liberalism. The foundation of neoliberalism is the work of the British economist named Friedrich von Hayek and an

American economist Milton Friedman, both rejected the government fiscal policy and argued that government intervention leads to totalitarianism. The major conservative political parties of the United States embraced their views. In 1995, with the abandonment of ownership of means of production by British labour party, the neoliberalism ideology became influential (Biebricher, 2019).

Contemporarily, Neoliberalism is used as reform policies for market and production including dealing trade barriers, price controlling methods and capital markets through privatization and less involvement of state in economy. It is also commonly associated with the economic policies introduced by Margaret Thatcher in the United Kingdom and Ronald Reagan in the United States.

1.8.2 Propositions of the Theory

- A principal element of the neoliberalism is privatization which refers to the deregulation of industries and business of government and shifting to private sector. It includes owning all state entities and business to private sector including utility companies, health sector, transportation and educational institutions. The aim of privatization is to achieve efficiency as private sector is recognized more efficient in running business. However, it often results in profitability motive and achieving the goal of public good as the wealth remains in few hands.
- The reduction of government regulation on economic activities such as imposing taxes on business or trade freely. The concept of deregulation allows various business companies to become more profitable as the state withdraw from all the economic and social activities.
- Free trade is comprised of open investment and trade between two parties with total freedom and movement of capital. Marked by globalization, with better and cheaper resources, economic growth is expected to occur whereas it may exploit unregulated market.

- The reduction of public expenditure is dependent upon the private sector that how they manage the healthcare and education services as government expenditure is mainly focused on health, education and infrastructure.
- The individual and competition be granted supremacy over all. The production, nature and work is measured in monetary terms. The concept of welfare state and collective responsibility is destroyed. People are motivated to work for their well-being rather than the whole society. The poorest segment of the society is eliminated as welfare and social programs are adversely effected under neoliberalism.

1.8.3 Application of Theory

The present study focuses on the use of modern pesticides in agricultural field and its impacts on human health and environment. The major characteristics of the neoliberalism theory is connected with the present study. The paradigm of economic neoliberalism undoubtedly raises hope for property but it raises many concerns about the protection of environment. The main postulate of the theory i.e. **Deregulation** give rise to the destruction of environment as pesticide companies are not under the control of government. Major pesticide companies work more for the economic competition and farmer use pesticide with less familiarity due to a kind of marketing of sales representative. They attract and convince farmers through various packages and promise crop high productivity. Under these conditions farmers use excessive amount of chemical pesticides which has adverse impact on ecosystem.

The **free trade** between the two parties i.e. pesticide companies and farmers create many health hazards for farmers. Under the notion of sense of competition, farmers has shifted from traditional ways of pest control to inorganic methods. They do not care about their health. The farmers view nature in terms of production and least care about it. They give predominant value to agricultural production. Farmers are under the fear of crop damage and not getting high yield, so they prefer to adopt pesticides in field without calculating the negative impacts of pesticides on soil and other species.

1.9 Outline of Research

Succeeding the introductory chapter of the thesis, the second chapter reviews the relevant existed literature on the study and objectives by presenting theoretical framework. The third chapter is divided into two sections. The first section explains all the methods, techniques and tools employed to conduct this research. The second section of the chapter delineates the important physical, cultural, social and economic features of the research locale relevant to research phenomenon.

Following the structural chapters of the study, the remaining chapters of the thesis includes three chapters of findings and a summary of the thesis. The chapter four comprehensively explain the types and use of pesticide in research area. The chapter five provides a detail account of the perception of farmers about the use of chemical pesticides. Chapter six explains the impacts of inorganic agricultural materials on environment including soil, water and animals whereas chapter seven describes the impact of pesticides on the health of farmers and various diseases caused as the effect of pesticide consumption. Chapter eight being the last chapter of the thesis summarizes and concludes the key findings of the research. The appendices consists of an interview guide and socio-economic census used for data collection.

Chapter 2

REVIEW OF LITERATURE

Several ecological studies have specifically proved the impacts of pesticides such as DDT. A study found an association between pesticide use and increased mortality rate with liver, breast and uterine cancer whereas lacking data on the harmful impacts of chemical pesticides as prostate or testicular cancer mortality. Majority of cohort studies have illustrated positive link between pesticide exposure and diseases including brain cancer, pancreatic cancer and leukemia. (Alavanja & Samanic, 2003) Some studies also have data related to association with cardiovascular diseases and possibly diabetes but failed to found increased mortality with pesticide exposure. Breast cancer among females is the most intensively investigated result of pesticide use such as DDT. During early 1990s, a study suggested a relation between organochlorine pesticides and breast cancer. At the same time, other case studies did not support the hypothesis and believed that pesticide exposure act as tumor promoters. Cellular researchers have also suggested that pesticide exposure may be linked with human breast tumors (Beard, 2006).

Wickerham, Lozoff, & Shao has conducted a study in 2012 which has identified pesticide impacts that its human exposure is linked with several serious diseases such as hypersensitivity, asthma, allergies, cancer and hormone disruption. Based on several evidences of infants and children health, its exposure leads to fetal death, birth complexities and defects. The consumer and occupational exposure of human to pesticide has real risk on human health with predicted impacts on environment. In light of scientific evidence, pollution is the primary environmental impact of pesticide. Pesticides create pollution, transfer chemicals to soil and have negative impacts on human health (Wickerham, Lozoff, & Shao, 2012).

Lubomir I, Fliur , & Biana has explained the considerable negative effects on environmental agents and other living creatures including water, soil and air in a study conducted in southeast Europe. Based on the findings of the study, it was found that some pesticides such as aldrin, chlordane, dichlorodiphenyltrichloro-ethane (DDT), endrin and heptachlor are consists of organic pollutants which do not degrade with time and remain a

part of environment for many years. The repeated use of pesticides has resulted in loss of biodiversity and pest resurgence. It was estimated that almost 95% of the pesticide remains in the environment and dispersed. It effects non-target organisms as well (Lubomir I, Fliur, & Biana, 2013).

Rull & Ritz in 2003 has explored the impacts of pesticides in California. It was revealed that the pesticide application may cause airborne pollution through volatilization and aerial spraying methods. Through the process of ventilation, heating and cooling air currents are produced which makes the spread of pesticide possible in indoor environment. The tropospheric ozone level contains 6% of the pesticides. A study in Canada suggested that the level of pesticides in environment and eatables are measured in potato farms in which a high concentration of pesticides were found due to its repeated use in farms. Another study in California illustrated the ground level concentration of pesticides and fungicides in air with high intensity. The presence of these pesticides were the cause of potential exposure to wildlife, human and environmental agents (Rull & Ritz, 2003).

Various epidemiological and clinical studies focusing on the exposure of pesticides have reported symptoms of asthma and bronchial hyper-reactivity in humans. Pesticide absorption results in irritation, endocrine disruption and inflammation which causes Asthma. In 2015, a study on mothers and children in USA was conducted which investigated the relationship between respiratory ailments and pesticides at an early age. The farm workers have increased chances of developing asthma with their children subjected to childhood asthma. In Africa, ocular-nasal issues are associated with people working in farms or entering after pesticides spraying in the field (Raanan, Harley, & Balmes, 2015).

Based on epidemiologic studies, Parkinson's disease is a consequence of occupational exposure to pesticides. A study in France examining occupational exposure and its effects suggested high mortality with Parkinson's diseases was observed. The relationship between certain pesticide, fungicide and insecticides and Parkinson's disease was reported. It was observed that people with no family history has developed Parkinson's disease due to pesticide exposure. In addition, it was found that the duration of exposure was a deciding

factor in determining the cause of the disease and controlling the magnitude of the effects of pesticides (Chorfa & Lazizzera, 2016).

There has been growing evidence of association between neurological diseases and pesticide exposure with limited neurobehavioral effects. An investigation in Sweden measured that people with high exposure to pesticide have three times more chances of developing cognitive impairment than those with low exposure to pesticides. Another study in France with have monitored low cognitive working abilities in workers with pesticide exposure. Different studies on prenatal exposure of pesticides have reported that children suffer with lower IQ and poor working memory. In simple terms, children who have pre-natal exposure to pesticides have higher chances of developing cognitive impairment later in life (Lee, Lind, & Lind, 2016).

Karabelas, Plakas, & Solomou demonstrated that since 1950, the use of pesticide has been increased and currently there are numerous products available with chemical combinations in markets and used worldwide. Therefore, the pesticide market has surged in 2008 which means that farmers were likely to spray more and expect pesticide effectiveness as increased crop yield. The Committee on the Future Role of Pesticides in US Agriculture, 2000 has taken legal actions on the risks of pesticides on human health and environment which has made the use of pesticide uncertain in many agricultural societies. Several studies based on human health have identified potential health risks (Karabelas, Plakas, & Solomou, 2009).

Panuwet , Siriwong, Prapamontol, & Fiedler in 2012 investigated the use of pesticide in Thailand. The study has manifested that insecticides have become more commonly used group of pesticides. They have acute effects on nervous system enzyme called acetylcholinesterase. Acute diseases caused by insecticides are blurred vision, pulmonary edema, weakness, muscle spasm, respiratory difficulty. It can also cause death to respiratory failure. Several farmers working in Thai farmers have reported these symptoms as well as vomiting, chest pain, numbness in hands and feet and nausea. These symptoms caused by insecticide exposure are reversible and result of poisoning due to which majority of farmers do not seek medical attention (Panuwet, Siriwong, Prapamontol, & Fiedler, 2012).

Huen, Barcellos, & Beckman have conducted a comparative study on the children of United States and Thailand in 2011. The results of the study depicted that the effects of pesticides on the health of adults and children vary due to physiological and behavioral differences based on pesticide food consumption and exposure. (Needham & Sexton, 2000). The growth and development of children are hindered genetically than adults and are more susceptible to pesticide toxicity. Numerous birth cohort studies have documented that children are highly exposed to various categories of pesticides due to widespread pesticide usage in all countries of the world. Furthermore, apart from children who consume pesticide food, the children of farmers are more prone to develop harmful effects of pesticides due to using farm area as their playground and spending majority time near occupational area and materials. Studies have shown that by biomonitoring of urine, it is assessed that Thai children have higher pesticide exposure than children of other countries such as United States. Additionally, the urinary metabolites of these children were double in comparison with US children. Due to ineffective pesticide management, children are exposed to pesticides in various ways in Thailand (Huen, Barcellos, & Beckman, 2011).

Hildebrandt, Guillamon, Lacorte, & Tauler argued that the agricultural practices in Spain are predominantly dependent on pesticide use due to soil and climatic conditions which increase the risk of effecting the quality of groundwater. To combat weed, insects, pests and fungi, more than thirty different types of chemical pesticides are used. During a study, pesticides of various were found to be used during cultivation periods of April-October. No adequate monitoring program was used to measure the impact of pesticide on soil and groundwater quality (Hildebrandt, Guillamon, Lacorte, & Tauler, 2008).

Skinner, Lewis, Bardon, & Tucker recognized the harmful effects of herbicides on water such as water pollution since 1970. The impacts of pesticides on water has two areas of concerns. One area is how pesticides pollute rivers and other water surfaces and effect aquatic life whereas another is how it contaminates human drinking water and effect human health by causing various diseases. EC Drinking Water Directive have addressed this concern which concludes that pesticides have high ratio in potable water. The issues of pesticide effects on flora and fauna have been addressed by English Nature and Boxworth Experimental site. The long term effects of pesticides are uncertain whereas it has short

term effects on wild life. For most pesticides, there are no long term effects. Molluscicide used also kill local population of mice whereas the rabbit species has showed liver cell damage due to pesticide use. Herbicides and fertilizers together have primary role in degeneration of wildlife and vegetation (Skinner, Lewis, Bardon, & Tucker, 1997).

Wilson & Tisdell in 2001 had examined the level of agricultural production which has been increased by the use of pesticides as well as its sustainability whereas it has negative heath impacts on the farmers, consumers and people living near farms. Exposure to pesticides causes death in various areas in not uncommon. In developing countries, due to exposure to pesticides, thousands of farmers are effected each year. The largest number of farmers died belong to developing countries. Moreover, besides human effects, evidences from various studies have shown that pesticides also effect animals by causing immune dysfunction among animals. A study showed that women who drink groundwater contaminated with pesticides have low immune response whereas these women do not show any overt health issues (Wilson & Tisdell, 2001).

Werf in 1996 have studied the use of pesticides in early times and its impacts on living organisms. Based on his study, during 1940s, the first synthetic pesticide was introduced which has large benefits in increasing agricultural yield. Later in the early 1960s, the adverse impacts of pesticide use on human health and environment was voiced. Debates and studies on the benefits and risks caused by pesticides have been conducted since then.. Pesticides do not only harm the target organism. It has unintended environmental impacts. Living organisms including humans inhale pesticides through ingestion of water and food or contact with skin which has toxic effects of diverse nature. In the restricted sense, the pesticide exposure cause immune dysfunction to human being. Recent studies shows that pesticides can cause a variety of disorders mainly damage to immune system, disrupt endocrine system not only in humans but also in animals (Werf, 1996).

Hassaan & Nemr inquired about the categories of pesticides and how they effect living things. The findings determined that the several categories of pesticides perform different mechanism to contaminate living organisms. These mechanisms involved bio-magnification and bio-concentration. Being involved in a wide variety of micro pollutants, pesticides have negative environmental effects. In bio-magnification, the chemical level in

any food is increased due to the presence of pesticide. When eaten by living organisms, the chemicals are gradually amplified in the organs and tissues of the living organisms or the organisms who eat other living organisms exposed to pesticides. Including humans, a very high level of pesticide consumption is being observed. On the other hand, Bio-concentration is defined as the process through which the chemical is transmitted into the organisms through fat tissues (Hassaan & Nemr, 2020).

Zhang, Zeiss, & Geng has documented the advantages of pesticides use such as food security and crop production as well as the unintended negative impacts on ecosystem and human health. Soil, water, air and non-crop vegetation all are contaminated by pesticides. Pesticides can kill pests but also harm non-target population such as fish, insects who are beneficial, birds and other organisms. Among the various types of pesticides used, Insecticides are generally the most toxic class of pesticides for animals and humans. Other than insecticides, fungicides and herbicides also cause harm to organisms. Pesticides manufacturers have been striving to produce less harmful pesticides due to adverse effects of pesticides. Currently, pesticides available in markets are less harmful than older pesticides and pose less threat to human health and environment. For instance, the use of toxic pesticides are replaced with less chemically composed pesticide in California (Zhang, Zeiss, & Geng, 2015).

Corriols, Marin, Berroteran, Lozano, & Lundberg has worked on pesticide poisoning. They have concluded that the pesticides are used all over the world for killing pest and protecting the crop. Apparently it has proved socio-economic benefits for farmers but knowledge of adverse effect of the pesticides exposure on human health used to be limited. Currently, pesticides exposure impacts on human health are recorded rapidly mostly among under developed countries because of poor management including awareness of the hazards. Lak of proper care during usage of the pesticides, less availability of modern equipment and inadequate protective material in developing countries result in accidental and intentional poisoning, due to no consideration of high toxic substance (Corriols, Marin, Berroteran, Lozano, & Lundberg, 2009).

Cooper & Dobson in 2017 has evaluated the pros and cons of pesticides in agricultural field. They have analyzed that the use of pesticides do not only have negative impacts on

human health and environment, if used rationally and carefully with the help of the pest management system including technological integration than it is more justifiable, when highlighting the benefits of pesticides to encourage the user, while provide proper awareness through training session, manufacturer provide instruction along with product. The lack of high education in farmer unable to read, perceive it, so there is need to modify medium of the delivering message towards peasants for safe and proper use of pesticides. The potential benefits are particularly in developing countries, million dollars add in national income also contribute malnutrition (Cooper & Dobson, 2017).

Sharma, V, & Shahzad has explored the effects of pesticides on soil. The key findings of their research has illustrated that the pesticides used in agriculture get absorbed in the soil as they are synthetic in origin. From the treated crop or plant, they runoff to the soil. Various factors such as the cropping practices, pesticides spraying and irrigating techniques as well as climatic factors are responsible for dissolution of pesticides in soil. The pesticides components in the soil further pollute the groundwater which affect the quality of the crop. Through the direct application and domestic purposes, the pesticides get accumulated in the soil. Soil serve as storage compartments of the chemicals from pesticides which becomes a part of the diet of other organisms and effect soil ecosystem, water bodies, plants and human health. Globally, the extensive use of pesticides, have adverse impacts on the ecosystem relative to its ways of application (Sharma, V, & Shahzad, 2018).

Oves, Khan, Iqbal, & Ismail have explained that the pesticides become integral part of the modern agriculture system. Major proportion of the pesticides applied in agricultural practice do not effect targeted pest only but it has effects on non-targeted species. The frequent use of the various chemical toxic leads to lose the biodiversity. Such sort of continuous use of pesticides creates different health and ecological problems, due to repetitive use of pesticides observed contamination of environment and spilled skin also results in the death of agricultural workers (Oves, Khan, Iqbal, & Ismail, 2018).

Shetty has studied pesticide use in India and indicated that the adoption of modern farming techniques to improve irrigation system with agrochemicals and high yields contribute to good production. Similarly, this kind of farming mechanism cultivation has high yield

varieties leads to mono culture of commercial cropping. It loses the sustainability of the crop due to weeds and the attacks of diseases pre and post-harvest, even though the use of pesticides high but crop damaged with multiple ways climatic unfair seasons including effects of the pesticides. It would be proved better for commercial crop and mostly the use of pesticides observed in region, where adopted commercial farming system with the help of pesticides high yield varieties resulted most beneficial in that regions (Shetty, 2004).

Khan has investigated the reasons behind the use of pesticides in agriculture by the farmers. The research has found that the reasons behind choosing the pesticides is a lack of alternative pest management technique, the farmers do not have proper information and access towards alternative methods, and therefore they prefer the use of pesticides without consideration of reservation. Similarly the pesticides are easily available in each agricultural region. The farmer are afraid of economic lose, so they use pesticides frequently to avoid crop damage. On the other hand, the most of the famers are uneducated, so pesticides companies succeed to convince the farmers through persuading them that without the use of pesticides, crops cannot be protected from pest, the pesticides draw attention of farmers with various kind of exploitation as high yield varieties distribution prizes including proving free items of pesticides, due to cultural believes regarding farmer cannot not determined the health effect raising from the pesticides (Khan M. , 2010).

Raksanam, Taneepanichskul, Mark, Roban, & Wattasit in 2014 has analyzed the health risk behaviours regarding agrochemical exposure. Due to the lack of attention to safety precautions farmers get effected from the pesticides. During spraying, not using the mask after using pesticides, improper hand washing before eating something, lack of protective technique for use of pesticides, lack of technological equipment for spraying, no use of appropriating clothes for spry and agrochemical use, drinking water often on work side, standing close to spry inhaling pesticides result in acute poisoning with symptoms mostly vomiting, nasal irritation, skin rash, weakness, eye irritation, headache, fatigue. The pesticides protect the crop results in the rise of various diseases in farmers (Raksanam, Taneepanichskul, Mark, Roban, & Wattasit, 2014).

Sharma, V, & Shahzad has explored the effects of pesticides on environment. It was delineated that the major aim of pesticides application is to increase crop productivity

whereas within due course of time, pesticides and chemicals become a part of soil and environment. The contamination of environment is the result of extensive application of pesticides which finally enters the food chain and have adverse effects on human health. Air pollution is also caused by the commercial use of pesticides through the production of vapors. The main factors including application procedure, changing environmental conditions and chemical properties of the pesticides become the cause of air pollution. The process of volatilization of water adds pesticides into the air which later in the form of degraded products get dispersed and transported from one area to the other (Sharma, V, & Shahzad, 2018).

Khan, Alam, & Bashir have studied the farming community of Pakistan and initiated that the extensive application of pesticides for agricultural production is a major environmental concern and health issue for farmer's community and general public. Majority of farmers rely on the mixture of chemical substances as pesticides to control pests and diseases. These chemicals are highly toxic to the biological system and human health. The contamination of air, soil and water is caused by the result of careless handling and use of pesticides by farmers. These pesticides enters the food chain either directly or indirectly and cause a variety of human diseases. The reliance of farmers on pesticides, poor handling and training facilities are the main factors of risks in environment. Government requires strict regulation on the production, regulation, distribution and handling of the pesticides as well as effective training of farmers with proper knowledge about the impacts of pesticides to reduce health and environment risks. These practices will mitigate the adverse effects of the pesticides on environmental factors and human health. Alternative methods can also be used including plant extracts and natural products for crop products and pest control (Khan, Alam, & Bashir, 2020).

Iqbal, Zia, & Ahmad have inquired about the occupational and technical irregularities due to injudicious use of pesticides in Pakistan. According to the research on the impacts of pesticides on environment and human health, there are no pesticide monitoring system in farms or fields. No specific ways or criteria is used for the selection of pesticides by farmers. Concerning pesticides, there is a need of strict enforcement of existing rules due to overall bleak situation of pesticide use in farms. Agro-chemicals are used without any

regulation and proper use of pesticides. Recent legislation lacks the concern about the frequency and quantity of pesticides used in agricultural field. Mainly, the pesticides are used on cotton, wheat and sugarcane crops as well as for fruits and vegetables. The cotton crop has utilized approximately 90% of the pesticides according to an estimate. Pesticides are selected on the basis of its availability by farmers or they follow other farmers. The suggestions of dealer or landlord also play an important role in the selection of pesticides for crops. The cultural practices involving weeding, hand picking and harvesting can catch the injurious effect of pesticide while mixing and spraying on crops. Usually, farmers only warp a piece of cloth around their face during the use of pesticide. No protective measures including goggles, boots, gloves or respirators are used (Iqbal, Zia, & Ahmad, 1997).

Chapter 3

RESEARCH METHODOLOGY

The research methodology plays a role of guide from initial step to the final ending. It includes several tools and techniques used during research. According to Pelto, the methodological apparatus in anthropology requires great sensitivity and reflexivity on the part of the investigator (Kothari, 2004). To collect data, the researchers used different methodological tools and methods which are as follows:

3.1 Participant Observation

Participant observation makes the observation unobserved. In research methodology, it offers new insights to the topic. It is associated with active participation (Keiding, 2011). It includes developing association with people to make them comfortable in order to reveal appropriate data about the research topic (Bernard, 2006).

In research community, this method has enabled me in the collection of quality data as through actively participating in the field activities with farmers, close observation became possible. It was the preliminary step of my fieldwork to develop connection with people through participant observation and rapport building. Participant observation is associated with rapport building. The active participation has helped me to develop rapport with my research respondents.

During the start of fieldwork, I had studied about agriculture and pesticides for the purpose of developing easy communication with the farmers. Initially, I had informed them about my identity and purpose of research. I have tried to utilize maximum time with them in the field to develop good rapport through discussion on topics related to their daily life and farming which has later assisted me to use other research methods. To develop rapport with farmers was not much difficult process for me as I have initial knowledge about their occupation and farming in general and did not have any language barrier.

3.2 Key Informants

In qualitative research, the selection of key informants is a source of access to field and respondents. I have selected two key informants. One of them was a farmer associated with farming from eight years. He was forty years old. Another key informant was the pesticide seller who supply chemical pesticides to the farmers. He was thirty two years old. Both the key informants were selected during initial stage of rapport building process. They have helped me in sampling process and conducting interviews with respondents.

3.3 Socio-Economic Census

This form has helped to get information about the socio-economic characteristics of farmers including age, education, family and income which has impact on pesticide perception. I have filled census forms from hundred households of the research area from which I have shortlisted farmers. The sections of the socio-economic census is directly linked with research findings.

3.4 Sampling

Sampling is a process of selecting individuals from a large group of population. The target population of the research was farmers who use inorganic pesticides in their fields. Thirty farmers between the age 25-50 who use chemical pesticides as well as five pesticide sellers and five doctors were selected as research respondents to get comprehensive data about the topic. The size of research sample was forty.

3.4.1 Purposive Sampling

It is a non-probability sampling use to collect the target population for the purpose of the research. It is often called particular, judgmental and subjective sampling based on research criteria (Ryan & Gery Russel, 2010).

The objectives of the current research specifically focus on the phenomenon of pesticides, their use, perception and impacts on human health and environment. By keeping in consideration, I have used this sampling technique by selecting farmers who use chemical pesticides proving the notion of the research topic.

3.5 In-depth Interviews

I have conducted twenty in-depth interviews with the help of interview guide. These interviews were recorded by using audio recorder. The interviews were conducted by the will of the respondents depending on their free time and single sitting.

The interviews also contain discussion with respondents with one-on-one engagement with them. The topics for the discussion of these interviews were the perception of farmers about pesticides and death incidents occurred in research area due to pesticide poisoning. These discussions are helpful as they reveal data which is not easily revealed. The in-depth interviews were based on detailed conversation starting from general to specific questions.

3.6 Interview Guide

I have developed three sets of questions based on several themes for my respondents relevant to research questions. The interview guide contains questions with open-ended response pattern. The list of questions generated for farmers and pesticide sellers followed the pattern of general to specific whereas questions asked from doctors are specific related to health and pesticides.

3.7 Case Study

In case study method, the case can be any individual, process, event, place and time. It is a detailed knowledge of the phenomenon or individual experience (Whitley, 1932).

Through this method, I have gained information about the personal experiences of the farmers about pesticides impacts. I have conducted five case studies related to the perception of the farmers about pesticides use and impacts of pesticides on human health and environment. During unstructured interviews and participant observation with farmers, I have revealed these case studies.

3.8 Focus Group Discussion

This method has allowed the respondents to discuss openly and comprehensively about their opinion. I have used this method by conducting a focus group discussion of ten farmers at a nearby place. I have informed my respondents about the discussion on farming and pesticides. They have suggested me a place near fields where they usually meet at

evening. I have informed them earlier that the whole discussion would be recorded like in-depth interviews. They have become more comfortable than they were in in-depth interviews and willingly participated in focus group discussion. This method was quite different from interviews as I tried to speak less during discussion and allowed respondents to discuss properly. Focus group discussion was conducted on topic including the negative and positive impacts of pesticides in opinion of farmers. It has revealed their perception about the chemical pesticide. The focus group discussion was recorded with the permission of the respondents.

3.9 Ethical Considerations

This research has carried out by the underpinning of various ethical practices. All the respondents were clearly informed about the aim of the research. The identity of the researcher has not concealed from the participants of the study. All the discussions and interviews were conducted with the informed consent of the respondents. Photographs have captured by taking permission from respondents. Likewise, interviews were recorded as per the will of research respondents. It was also ensured that during the time spent on farms, no property would be harmed and no farmer was discriminated based on the economic status.

3.10 Reflexivity

Understanding the meaning farmers give to pesticide usage in farming from their viewpoint, shaping believes and experiences and making it significant for others was a major aim of my research. Being a resident of Sindh province, I have been a keen observer of the phenomenon which has influenced my research and interest in pursuing this research topic. During the initial phase of my research, I had a general belief about the positive and negative impacts of pesticides on health whereas during the fieldwork, I was aware that during observing respondents and interviewing, I needed to be neutral by setting aside my previous worldviews about the topic. From the whole process of data collection to data transcription and analysis, my perspective about pesticide application and their impacts has enhanced. My ethnicity has played a pivotal role in rapport building and eliminating language barriers.

3.11 Field Notes

During my research, it was not possible to use audio recorder all the time. For this purpose, I have maintained a daily dairy to write field notes. In daily dairy, I wrote relevant observations, events and themes on daily basis which has helped me during data analysis. Data obtained from informal discussion and unstructured interview are also a part of daily dairy.

3.12 Audio Recording

I have used an audio recorder to record structured interviews and focus group discuss. This method has mitigated the chances of missing any piece of relevant data. The data recorded in the audio recorder was later transcribed, analyzed and categorized into themes relevant to research objectives.

3.13 Photography

Photography is a non-verbal tool to present relevant data. It helps the reader to understand the research findings properly. I have used my mobile camera as a photography tool to capture photographs of important pesticides and pesticides application by farmers. All the pictures were captured with the permission of the respondents.

3.14 Research Setting

To understand the phenomenon under study, the riguourous data relevant to the physical features, living patterns, socio-economic organization and culture of locale is required. This section includes detail of the essential features of research setting with demographic characteristics, economy and socio-cultural life of people.

3.14.1 Introduction to Research Setting

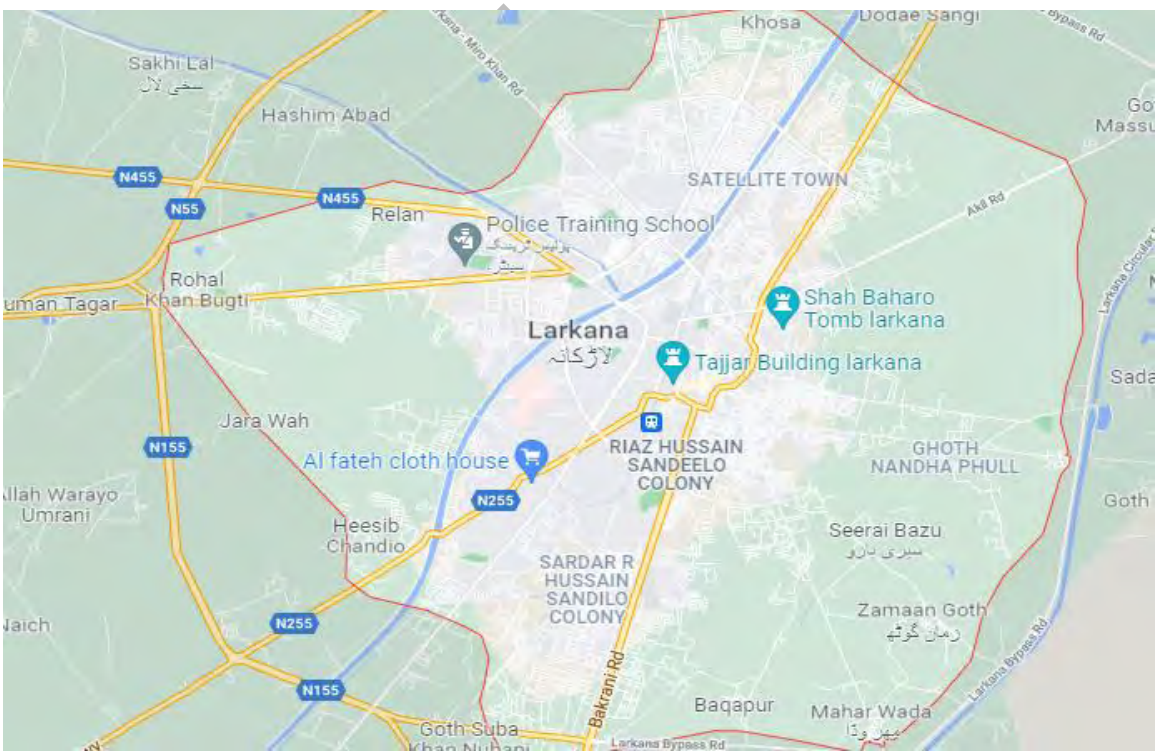
The research area selected for the study is district Larkana. It is known as the city of Holy Alams as immense number of Holy Alams exist in the city as compared to other areas of the world. The historic site Mohenjo Daro of Indus Valley Civilization is present there as it is home to Indus River which flows south of the city. The word Larkana is borrowed

from the tribe named “Lariks” who has inhabited in Larkana several years ago. Larkana city which is located within Larkana district is formerly called "Chandka”.

3.14.2 Location

It is situated on the south of Shikarpur about 40 miles at the bank of Ghar canal and north of Mehar about 36 miles.The total area of the distrcit Larkana is 5,091 sq miles. The headquater town of the district is Larkana. It is located in upper Sindh at a distance of 85km from Sukkur at west. The distrcit Larkana has strategic location per to the map of Sindh province. On the west bank of river Indus, it is considered as the second largest city of Sindh after Karachi. It has an altitude of 167 feet. The important towns of Larkana are Dokri and Naudero. It is situated between 27° 33' -40.4" North latitude and 68° 12'- 30.8" East longitude.

Figure 1: Map of Larkana



(Source: Google)

3.14.3 Historical Background

The district Larkana being the hub of oldest civilization has history of 4000 years known as Indus valley civilization. The remains of old civilization have been excavated from Moen-jo-Daro which is located from 18 miles at a distance from Larkana district.

The Hindu dynasty has the rule of town of Larkana in which Arore was the capital of the Sindh before the Arab invasion. The boundries of the district was extended towards south in Mekran, Kandhar in the west and Kashmir in the north. Rai Siharas was the most famous king of that time. In his reign, the persian attacked many times on Sindh which resulted in the defeat of Sindh.

He was succeeded by his son Rai Sahasi after his death. He was a wise man among other Sahara rulers. A Brahaman became his succeesor who has his brother successor named Chandai. He was succeeded by his nephew Dahir after ruling for eight years. Dahir was the eldest son of Chach. After that, Muhammad bin Qasim invaded Sindh. For about 908 AD, both Abbasids and Umayyad Caliphs rules on Sindh (Molai Shedai, 2013).

In 871 AD, after the decline of both Ummayad and Abbasid Caliphate, two separate kingdoms of Masura and Multan were inaugurated. The capital of Sindh was Bukkhar at that time when the area of Larkana came under the kingdom of Mansura. In 1019 AD, Sultan Muhmud Ghazni conquered sub-sontinent. Siindh was under the authority of the Caliph during the time of the invasion. Muhammad Abdul Razai was the representative of Sultan Mahmud Ghazni. After conquering the areas of Kach and Multan, he sent his representative to capture Sindh who died in 1026 AD. Later, the sumra dynasty was founded when the ruler of the Multan named Ibn e Sumar occupied the country. The soveriengty of the Ghazanavides was only in name whereas the Sumra rulers actually rule the country. A Sumra king named Khafif successfuly ruled the country. Dring his rule, Thatta became the capital of the country. After the death of the caliph Khafif, the Sumra reign dwindled and tge last ruler of Sumra was killed in 1451 (Abro & Shaikh, 2022).

In 1739, Nadir Shah conquered all the provinces in the west of Indus river including Dehli, persian empire, Shikarpur and Thatta. The areas of Sibi and Shikarpur was conquered by Afghans after the surrender of Nadir Shah. In 1768, the city of Hyderabad was discovered by Ghulam Shah Kalhora. The city of Hyderabad was initially called Nirankot. Ghulam Shah Kalhora ived in the city till his death and died in 1772. Mir Fateh Ali Talpur came to power in 1783 after his death. The Talpur reign was categorized into three mahor families that ruler different areas including Shahdadpur family rulinh Hyderabad, Manikanl family ruling Erpur and Hohrabanl family. Several areas such as central Sindh, Mirpur, Khairpur and Khalrpur were ruled by them till 1847. After that, British forces defetaed their forces and started thier rule by Sir Charles Napier who was the first governon of Sindh and exercised the military and political authority. Sindh enjoyed the status of a province till 1927 (Ali & Mushtaq, 2019).

3.14.4 Climate

Larkana has a hot desert climate with extremely hot summers and warm winters. The average temperature recorded in summers 48°C whereas the minimum is 33°C. In winter season,the minimum teperature recorded is 11°C and maximum average temperature reaches to 21°C. The precipitation level is 115mm. The monsoon season starts from July and end in september. In monsoon seaseon, the annual rainfall is recorded as 127.4 mm. In 1994, the highest annual rainfall recorded ever is 580.2 mm and the lowest annual rainfall recorded is 7.1 mm (Oad & Saad, 2019).

3.14.5 Physical Features

The Larkana district is divided into three major parts with two physical divisions including railway line and rice canal. The portion of railway line is located in the east and is densely populated. In current times, it has become a commercial center. This part of city include areas such as Jinnah Bagh, Ghareeb Mukaam, Karma Bagh, , All Goharabad, Galib Nagar, Gajanpure, Dari Muhalla Qafila Sirai, Murad Wahan, Surahia Padhar, Kadri Muhalla, Allahabad Zulifiquar Bagh and Leelaabad.

The second part of the city is situated between the railway line and the rice canal which is located on the west of the first location. It consists of main buildings of colleges, schools, national offices and colonies including Boys Degree College, Chandka Medical College, SP office, Circuit House, Chandka Medical Hospital, DCO office, High Court, Sir Shahnawaz Library, Peoples Colony, Pilot Secondary School, Doctors Colony and , Lahorri Muhalla.

The last part of the district is situated on the north west side of the rice canal. In final part of the district, there are housing societies and nwely developed colonies between the area of Ghar Wah and rice canal. It includes colonies including Sheikh Zayed Colony, District Jail, FM Radio Station Larkana, ,Director Education, Children's Hospital, Sheikh Zayed Women Hospital and Police training center.

3.14.6 River and Lakes

The river Indus flows from nouth to south of the district near Ratodero and Dhokri and touches the border of Larkana taluka. Mountain rains cause hill torrents which are locally termed as Nais. They dry up automatically after the rainy reason. The district Larkana also contains several lakes which are locally called Dhands. The rivers and lakes retain water for a long time.

3.14.7 Population

Larkana is considered as the fourth most populated city of the province after Karachi and Hyderabad. By population, it is considered as the fifteen largest city of Pakistan according to the census 2017. It has a population of 1,524,391 (Khosos, 2020)

Table 1: Population Categorization

Population	Total Percentage
Male	51.56 %
Female	48.44 %
Urban	28.90 %
Rural	71.09 %

(Source: Socio-economic Sample Survey, Larkana)

3.14.8 Educational Facilities

Larkana district has the literacy rate of 35% which is the second highest literacy rate in province Sindh. In contrast with the other rural areas of the district, the city areas have high lietracy rate. There are several private and government educational institutions in city whereas the district comprises only two univeristies including Shaheed Mohtarma Benazir Bhutto Medical University and Quaid e Awam University of engineering science and technology.

Educational plays an important role in the adoption and application of pesticides. In Larkana, mainly farmers have eudcational qualification as primary due to which they are unable to understand the pesticide composition and mechanism. The occupational hazards are also a result of lack of education as they are unabe to read the precautionary measures and expected harmful effects. The comprehension of the farmers about inorganic products is solely dependent on the pesticides sales man.

Table 2:Distribution of Literate Population by educational attainment

Educational Level	Percentage
Primary	45.9
Middle	30.9
Intermediate	19.5
Graduate/ Post Graduate	3.7

(Source: Socio-economic Sample Survey, Larkana)

3.1.4.9 Economy and occupations

People of the district are ocuupationay connected with many professions, small industries and bussiness. The rural people are mainly dependent on agriculture and livestock whereas in cities people prefer to work in industries. Livestock helps people to get dairy products such as yogurt, butter and milk for household use as well as held in economy. The female population of the area work in the fields with males. Some people are associated with skilled labor occupation as masons, goldsmith, carpenters and blacksmith. Majority of people are connected with teaching and law profession whereas a few people belong to geovernment offices.

3.14.10 Agriculture

A large segement of the population of Larkana is associated with agricultural activities both small and large scale farming depending on their capital, availability of land and resources. People grow several crops as well as various vegetables. They use inorganic products to control their farms from pest and insects attacks.

3.14.11 Major Crops

In research area, there is fifteen percent cotton and rice crop cultivated on different areas. The cotton plant is very sensitive and it did not have capacity to bear heavy damage of the insects. There are one hundred and fifty various insect attacker which attack in different phases on crop, so the cotton farmer use various pesticides to protect cotton crop from insects.

There are three main phases of the attack on the crop, 1. (*Ras chusendar* insects),2. (*gogro khy sorakh arin wara* insects), 3. (Attack of insects due to climatic change). The main insects which mostly attack on gross level crop as leaf are jacid (*Sao Mahlo*), Thrips (*Thariro*), white fly (*Achi Makh),* Aphid (*Sust Mahlo*), Mealy bug (*melly Bag*).

The second types of the insects which attack on crop on time of crop making fruit are Spotted Boll worm (*chatmakro Keeo*), Green or American Boll worm (*Sao ya American keeo*), Pink Boll Worm (*Gulabi Keeo*).

The third phase of attack on crop always damages crop when come in changing in climate. When suddenly warm air or high temperature starts and unseasonal cold weather occurs they attack the field. It includes Leaf roller (*Pan Verihee*), Cut worm (*pan katrindar Keeo*), Army worm (*lashkiri Keeo*), MealyBug (*melly Bag*).

Currently, every farmer is dependent on the modern agriculture techniques and pesticides. The traditional seed varieties have vanished gradually. Hybrid seeds have less resistance capacity from attack of various worms in crop. Similarly, farmer are less educated with no awareness of pest preventive measure or traditional controlling techniques. People are under the fear to damage crop and no getting high yield, so they prefers to adopt pesticides in field without calculating the negative impacts of pesticides on soil and other species. Framers are using different kinds of herbicides and insecticides to prevent worm attacks.

3.14.12 Irrigation System

As the border of the district touches the river Indus, the district is covered by river bunds. During raing reasons, these river bunds work as a proctection from hill torrents for irrigated areas at eatern and western side of the district. The District Larkana has total irrigated area of 870,127 acres. The irrigation system of the cultivation lands are performed through canals including rice canal, Warah canal, Dadu canal, Magsi canal, and Kirthaar canal. Water is obtained by using hand pumpms and extracted from wells in cities while in rural areas it is obtained from ponds or katcha wells. Irrigation can also be done by using canal water.

3.14.13 Industries

In the district there is low level of industrial development due to inavailability of raw material, insufficenticy of skilled labor and climatic issues. Among industries, textile and sugar mills are essential industries of Larkana. Besides large scale industries, there are various small industries including soap, silk and engineering work. A significant number of rice mills are also working in the area. Cottage industry is another established industry of the district as women make embroidered caps and poor people earn their living by handicrafts. The cottage industries are locally termed as sosi, angoshas and lungi.

Pesticide industry is another significant industry in research area which is growing rapidly as the farmers of the area have been extensively using inorganic agricultural materials since many years. Different kinds of pesticides and chemical seeds are manufactured with resistance against pests and insects.

3.14.14 Languages

The widely spoken language according to the 1998 census of Pakistan is Sindhi which is spoken by 98% of the population. Other languages including Brohi, Saraiki, Pashtu are also spoken by people. Urdu is easily understood and spoken by the whole population whereas English is only spoken by literate people. The current research is conducted in Sindhi language (Ali A. , 2021).

Chapter 4

FARMER COMMUNITY AND PESTICIDE USAGE

Soil in research area is facing acute shortage of organic matter since last couple of years. Different studies indicated that it is available up to 0.5 percent in Sindh. In some cases, it is only 0.002 percent, while healthy sufficient amount of organic matter is 1.29 percent to 2 percent to get good yield from crops and made soil healthier. (Khan, Alam, & Bashir, 2020) In this regard, the crop yield does not increase. The farmers maximize the use of pesticides to enhance the yield of crops, neglecting the side effects of the poisoned spray and fertilizers.

The fertile land is beneficial for farmers due to high yielded soil which provide sufficient amount of money for the survival of the peasant. The farmers observed the production of the crop including health of soil. The traditional or indigenous ways to prevent crop damage and increase organic matter of soil are used to enhance the fertile health of land, but the farmers focus less on these techniques due to the modern production of the nitrogen, DAP and phosphorus.

The farmers are using chemicals including good variety of the seeds. Unfortunately they do not get maximum benefit from the seasonal crop because of the main reason of the organic matter. The availability of chemicals and new hybrid seed diverted the peasantry attitude. But the agriculture system is working entirely opposite due to paddy system. The chemical fertilizers and phosphorus are available at each shop in market. The phosphorous fertilizers are less soluble product and have negative impact on the environment.

Figure 2: Phosphorus fertilizers

(Source: Photo by Researcher)

A farmer expressed: *"Qul chodanh faidemanda juza aahen zamen je pedawar lae par uhy maqami zamen men mojood ee nahin pur zarai dawon je market jo dhayan aahy faqatpotash, zinc, and phosphorus jeke zameen lae hanjekar aahen"* (Total sixteen elements are beneficial for crop higher production but there is no single element present in soil of locale. The agricultural products which market sell only focus on potash, zinc and phosphorous which are not sufficient for the crop higher yield rather have negative impacts on environment).

4.1 Commonly Used Pesticides

In farms of Larkana, mainly inorganic pesticides are used. The synthetic pesticides are also used including endrin, Aldrin. DAP, Chalorfenoyre, Acephate, amidachlrpid, Bifentherne, Emamctine, Steward, Polytrin-C, Profenofas, whereas the use of DDT is not allowed. None of the above mentioned pesticides are eco-friendly and have adverse impact on ecosystem. Some major types of pesticides used by farmers is in the following.

4.1.1 The Use of Diammonium Phosphorus (DAP)

The Diammonium phosphorus chemical is used by each of the farmer of Sindh. The DAP is high potential of Hydrogen (ph.) chemical, which is used for the softness of the soil. It is late soluble chemical, so it made hard upper layer of the soil due to excessive use of DAP. The soil of the locale is not as productive as much was in past. In this way, the chemical and pesticides companies are manipulating the farmer with the help of various product of chemical, on the other hand the famers are easily manipulated because of the reason that the agriculture land is not much capable to produce yield except the use of chemical. The soil get wet in upper level and its top layer become harder so it does not support the root of the plant to grow best. Soil is only soften during irrigation. In this way, much proportion of the fertile land of Sindh is kind of less sandy mud and chewing mud. The much potential of hydrogen and less resistant of wet soil, which is being affected badly by the chemicals.

A respondent narrated: "*Teeh fecad zamen mukhtalif khad aen zarai zaharan je kare pakki/sakhit thi wae aahy par hari khy khabar ee nahy"* (Thirty percent of the soil has become hard due to use of the different chemicals and pesticides, particular DAP is main reason of the hardness of the agriculture land including lack of farmer's knowledge).

The farmers often seek guidance from people associated with pesticide market. They believe that the pesticide industry help them to increase their farm productivity and control unwanted pest attack. A pesticide seller narrated: (Farmers have trust in pesticides that they always expect from us to solve their farm related issues. The major concern of farmers is to improve farm yield. They are not aware about the composition of the pesticides. They only use pesticide because they want economic stability).

Figure 3: Diammonium Phosphate Pesticide

(Source: Photo by Researcher)

4.1.2 The use of Vartako

It is one of the toxic kinds of pesticide used for crop. The residues of the pesticide remain in the environment from minimum seven and maximum fourteen days. As compared to other chemical pesticides, it is less harmful to animals and fish but effect beneficial insects. This kind of pesticide is available in the form of various product in different companies, Ferterra produced by the FMC, Vartako produced by Sgyenta and Ragitt producted by the Buyer.

Figure 4: Vartako Pesticide

(Source: Photo by Researcher)

4.2 Traditional Ways of Controlling Pests and Weeds

The unwanted plants grow on each crop naturally. They remain on the crop during their period. The weeds usually consume the food portion of the crop. A few of the farmers in the locale still practice traditional ways of controlling pests and weeds. In previous years traditional ways of weed and insect controlling methods were predominantly applied. There are various types of preventive measure exist to save crops from attacks of pest. Many traditional/cultural treatments for pest control such as Neem tree seed and leaves powder spry are used on cotton crop. The biological treatment involve spreading sufficient amount of the non-vegetarian insects which eat the vegetarian pest in the crop like Trichogrammatid. On the other hand, to observe the host crop or plant of pest destroyed, the farmers strictly abstain themselves to spread disease by own as mealybug spread through farmer's movement, they work in field one place to other so they took by self-own one piece of land to other. Similarly effected plants are cut with covering the particular plant and burn it. If it is thrown in water there is a chance of spread even on land.

Other methods such as half kilo gram salt and five hundred milli litre *Angor surka* mixed in twenty liters water and spray on weeds. After spray, the irrigation of the crops is stopped for ten days. It is also beneficial for the farmer health, soil health and organic matter as it did not have negative impact on friendly insects. It is one of the best eco-friendly technique for controlling weeds. Its resistance power is forty days for each crop.

4.3 Transmission from Traditional to Inorganic Methods

The knowledge about the types of modern seeds of farmers was very poor still they do not practice traditional agricultural methods and crop protection in the area. Majority of farmers switch to hybrid seeds and pesticides due to insufficient water because new seeds have more capacity of germination and low chance of deficit to peasant therefore each farmer prefers to grow the hybrid seed. Similarly, paddy system made bound farmer to companies' representative because of lending of all stuffs of the agriculture. The main cause of the shifting modern techniques and hybrid varieties of pest control are timing of crop including insufficient irrigation system of Sindh.

A farmer recounted: "*Asan jaded zarai tareeqa musmiati tabdilee aen bij sutho na milan kare apnayo aahy, pahanja bij and purana tareeqa hari je faide men na aahen tadhen zarae zahar paya estaimal kayon"* (we have adopted the inorganic agricultural methods due to climate change as the local seed is not sustainable for farmer including pesticides are the only way to save farmer's economy).

4.4 Selection of pesticides

The pesticides are being selected through the past experiences. The most reputable companies of the region are BUYERS & MFC. Some of farmer have adopted pesticides on the recommendation of the sales representative of pesticides companies. The sales representative draw attention of farmer through the services. If a farmer denies to grow his variety then Sale representative make farmer in his confidence and do not take price of the new variety of pesticide at that time. Farmers also request to sow one acre from his new variety and money would be paid during harvesting time. This behavior have developed a kin tie between the farmer and the companies.

4.5 Improper Use of Pesticides

The less information of using pesticides leads to contamination of soil and environment. There is circle of misunderstanding of the risk of the over use of pesticides. The pharmaceutical companies recommended 15% poison whereas sales man increases it to 20% after that the whole seller suggest the use of to 25% then distributor directed 30% and finally farmer use 35% spray of insecticides or herbicides. Most of the farmers use pre spray of poison in the field to prevent the damage of the crop. Some farmers use pesticides when crop is severely damaged so it would be difficult to recover easily.

A few farmers use pesticides timely and proper amount of the pesticides rarely. Interestingly, it is found that a very huge gap between farmer and pesticides representative exists. Farmers do not target the insects properly. They do not know the modern name of insects so they fail to convince the distributor and damage good insects too due to poisoning of insecticides.

There are many reasons for not getting expected result from the pesticides because of the various kind of pest exists in agriculture. They are in different shapes, forms, periods, stages and amount of pest along with insects. The monitoring of the crop is most significant also having knowledge about pests (harmful) and insects (friendly) is necessary for farmers to know first aid for each crop. If a farmer fails to control through traditional/cultural, mechanical, biological and botanical methods then move to inorganic methods. Some causes for having negative result from pesticides are mentioned below.

4.5.1 Improper dose of pesticides per acre

Framers use less amount of pesticides then recommended for particular crop. For instance, if some product has given instruction of use of 50ml in twenty litre waters for spray, the farmers use 30ml in twenty litres in first spray per acre. Sometimes, the pesticides recommend the use through throwing/sowing whereas the farmer use it in other way. In this way the specific pest get pesticide resistant. The same amount of dose do not impact on the pest.

It is recommended that the second dose of the pesticides should be less than the first i.e. if in first dose 50ml was used in twenty liters water then second time twenty five liters and

third time same amount of pesticides recommended to mix thirty liters water for spraying the same crop. The farmers of the area usually use 30ml in twenty liters water and spray three time the same amount of the pesticides then pest grow up their resistant power and farmer do not receive potential consequences of the pesticides rather have negative impact on environment.

4.5.2 Broad Spectrum

It is important to be aware about the stage of pest and target particular pest. If the farmer do not know the harmful pest and friendly insects, it would result in financial loss as well as pesticide over-use. The over-use of pesticides results in harmful insect getting resistant power in body then it is difficult for farmers to control the pest easily by the pesticides only.

4.5.3 Spray Methods

It is not easy for the farmers to kill sucking pest easily due to different time periods in different plants as at small plants, the pests live at leaves then in next stage the crops grow to get yield then pests change residence towards the top of plant and flower, so the farmer only use spraying method all time which is fair for pest but insects are hides in leaves. Spraying excessively have negative impact on the environment.

4.6 The Procedure of Pesticides

The pesticides flow on pest body directly which have result in twenty-four hours and its residues remain in environment for forty-four to seventy-two hours. In this way, some poisons are impacting through sucking pest when poison reach to belly of pest, such sort of poison impact after seventy-two hours and its residues remain for one week which poison the plant and other species. Third type pesticides are absorbed by the plant and work after one week and its residues remain for three week.

4.7 Knowledge about pests and insects

The farmers are least aware about the pest house and its rearing stages. Pests are growing in three to four phases till to reach danger level. The development processes called

metamorphosis includes various stages such as egg, larvae, pupa and adult. If a farmer is aware about the process of the pest then he could control the process of the metamorphosis. Similarly, the pest remained in the field after finishing the one crop and waiting for the other crop.

This is considered as the golden time for controlling the pest through the birds. After harvesting crop of the rice, many types of insects remain in surface of soil. It is termed as resting period of pest. When their season starts, they wake up again. If the farmer rear hen and duke in same field for one or two month then they eat all the remains of the pest at field and pests would not be active during the next season. In this way, the less use of pesticides have less residues and impact on environment.

4.8 Theoretical Discourse

Farmers in research setting prefer to use modern, inorganic and chemical pest control pesticides. The adoption of neo-liberal economic policies in research area has a significant change in rural production due to pesticide supplies. Consequently, the purpose of the discussion is to relate the neoliberal approach with the use and impact of chemical pesticides. The traditional or indigenous ways to prevent crop damage and increase organic matter of soil are used to enhance the fertile health of land, but the farmers focus less on these techniques due to the modern production of the nitrogen, DAP and phosphorus.

Tristan Jones and Andre Miller in their research "The effects of neoliberal capitalism on farmers" have stated that the growth of neoliberal market has made land a factor of economic importance than cultural significance. (Miranda & Moreira, 2007) The pesticides companies have become agricultural based free suppliers. The use of chemical products like DAP and Vertako for crop protection has correlated environmental and health damages. Farmers in expectation of more crop yield use pesticide extensively which adversely affect living health and ecology.

Chapter 5

FARMER'S PERCEPTION OF PESTICIDE CONSUMPTION

All the respondents of the study use chemical and inorganic pesticide to control pests without engaging in traditional methods because of high time consumption and application issues. They prefer the use of chemical pesticides due to a variety of reasons. The usage of inorganic pesticides is based on the perception and belief of farmers about pesticide use, application and consequences. Their perception about pesticide utilization is influenced by their economic conditions, demographic traits, pressure of farming community and pesticide market.

5.1 Determinants of perception

The farmers of the research area are not adequately informed about the chemical pesticides. They lack information about their proper application and composition. They merely decide about the use of pesticide by themselves. Several factors play a pivotal role in building the perception of farmers about chemical pesticides and influencing their decision making regarding the use of pesticides. A brief description of these factors is in the following.

5.1.2 Socio-demographic Characteristics

The farmers selected as research respondents belong to the age group 25-60 who have family association with farming but have shifted from organic methods of pest control to inorganic methods. The farmers of the research area who are above 60 years still prefer the use of traditional methods. Young and middle age farmers have adopted new methods and technologies of farming.

Besides age, the education of the farmers also play a significant role in determining their worldview about pesticides. Mainly, educational qualification of farmers belong to primary and secondary and a few farmers are graduates. Farmers with less education usually follow

TV and radio programs for agricultural and pesticide information whereas the educated farmers gave access to social media groups. Monthly income of the farm and household economy develops a positive perception of inorganic pesticides. Economy is an essential factor to develop and change the perception of farmer about pesticide.

A respondent narrated: *"Asan fsul Ghar khy halain lae pokhiyon tha so tadhen asan zarai zahar istmal kayon tha ta Jen suthi pedawar ache ta Jen asen wadh Khan wadh faido hasul kare saghon, na ta khuwamkhuwa asan cho zarai zahar khared kandsen"* (We cultivate crops to run our household economy. If a pesticide used on a crop helps in high yield, we prefer its use, otherwise why to waste extra money to purchase it.

Table 3: Personal Information regarding Farmers

Educational level of farmers	
Primary	10
Secondary	15
Graduate	5
Age of farmers	
Between 25 to 35	6
Between 35 to 45	8
Between 45 to 50	16

(Source: Respondents)

5.1.3 Influence of Pesticide Seller and Companies

The role of pesticide seller and companies is inevitable in the use and perception building process of farmers. Farmers purchase pesticides as well as seek guidance from the dealer about the adequate use of pesticides. The pesticide seller usually sell pesticide in a way that the farmers do not refuse to buy by telling the effectiveness of a pesticide. Framers prefer to get opinion from pesticide seller to develop their own perception.

A farmer narrated about pesticide seller: *"Asan zarai zahar istmal Karin na tha chahuyon par zarai dawae nimaido asan khy mashoro dino ta zarai zahar serf jet and keera khy Mari*

tho and fasul je quality ty ko asar kon tho kare" (Previously, I did not prefer to use pesticides as I though it has chemicals which effect the crop but when I meet a pesticide seller, he informed me that the chemicals are only effective for pests and insects and it does not affect the quality of the crop).

5.1.3.1 Case Study

It is the case study of a farmer who use inorganic products to control pests and insects attack and to save the crops. He is forty five years old and his educational qualification is primary. He has been associating with agriculture from past ten years. He discussed his experience of using pesticides and how his perception about chemical products has developed with the guidance of pesticide sellers.

The respondent narrated*: "Jadhan mun zarait mn kam karan shiru kayo ta mun fasal khe jeet jaran kha bachain lae purana tarika istemal pae kaya un lae mn wade pemane te makaami bijan jo istemal kayo. Par hi tariko ko edo kar aamad sabit na thyo. Po Munhje hik dost mukhe kemyai pesticides babat budhayo"* (When I started agriculture, I had use traditional methods of pest control and extensively applied local seeds. The effectiveness of traditional methods was slow. One of my acquaintances informed me about inorganic pesticides)

He met with a pesticide seller to get information about inorganic pesticides, its usage and benefits. His farm productivity was not satisfactory at that time.

The respondent further narrated: *"Bhaan khapaindar mukhe fasal mn kemyai dawain istemal karan ja faida budhaya. Hun munhji ehya ba rehnumai kai ta kemyai bhaan fasal ji pedawar wadhain lae cho zaruri ahe"* (The pesticide seller has informed me about the production benefits of the chemical pesticides. He also guided me about the chemical fertilizers and why I need these chemical products as my crop yield was low).

The farmer has adopted the inorganic pesticides to protect his farm from unwanted pests and weeds which has increased the farm yield and provided many facilities to the respondent. Previously, the farmer has been using organic and traditional methods of pest control. Pesticides sellers and companies has changed his perception about chemical

pesticides which has positive implications on the economy of farm. The farmers has adopted inorganic pesticides per to the suggestions of pesticide sellers which benefitted him.

5.1.4 Farming Society

Majority of the farmers in research area have adopted modern agricultural methods under the influence of other farmers. Similarly, the farmers seek ideas about agricultural products and pesticides from neighbor farmers under the belief that they have experience of working in agricultural field more than pesticide seller or other people.

A farmer recounted: *"Asan hari hik bie je tajribi man sabaq hasul kayon tha ta keen faido wathi saghon and nuqsan Khan bachi saghon tadhen hari wadi eimadari San zarai zahar istmal kan tha"* (I used to observe other farmers who have used chemical pesticides and view results of their application. The farmers who use pesticides are more honest than any other person about their farm profit and loss. So, we believe in each other's experience and act accordingly)

5.1.5 Personal Choice

Beside all these factors, several other reasons constitute the personal choice of the farmers including the expected crop productivity. Adverse climatic issues and severe pest attack which compel the farmers to use pesticides for crop protection. Few of the farmers also use pesticide for experimental purposes. The high effectiveness and personal experience of the farmers with enhanced yield of the crop is another imperative rationale behind the development of perception of farmers about inorganic pesticides.

5.2 Perception about the use of Inorganic pesticides

Farmers have varied perception about the use of inorganic pesticides despite the fact that they all use chemical pesticides to protect their crops from pests and insects attack. Farmers believe that the pesticides contain harmful ingredients and chemicals but they are content with the satisfactory results of the pesticide use. The perception of the farmers have largely formed under the influence of pesticide seller who inform them about the benefits of pesticides. The perception of the farmers are categorized based in their experiences.

5.2.1 General Positive Perception

In research area, a large segment of farmer's population have positive perception about the use of chemical pesticides. Predominantly, they believed that the main benefit of chemical pesticides is the desired or sometimes improved crop productivity which helps them in sustaining their economy. There is a local perception that insecticides and herbicides are the main factors of high crop productivity.

A farmer narrated: *"Sabzi hik nazuq fasul aahy Aen un ji quality khy barqar rakhan lae tamam ghano zarai zahar istmal thie tho na ta munasib qeemat nathi mile"* (vegetables are very sensitive crop and requires a lot of quality care. With the use of chemical pesticides, we are able to make it as a cash crop)

Besides economy, farmers also consider pesticides as a source gaining positive results in storage and enhancing the life of grains and vegetables by fighting against pests, insects, molds and rodents.

Another farmer narrated: *"Anaj store Karin men be zarae zahar Khan madad khansiwa Eho asan lae dukhiyo a"* (It becomes difficult for us to cultivate in a season because of extreme pest attack, so the storage grain due to chemical pesticide help us in that season).

5.2.2 Mainstream negative Perception

Beside the positive perception, a few of the farmers also have negative belief about the chemical pesticide based on their experience of the use of these pesticides. Farmers believe that the use of pesticides for regular pest attack is satisfactory, but in case of increases pest and insect attack, chemical pesticides fail and the whole crop destroyed. Apart from them, they believe that the residues of pesticides spray are absorbed by soil which decreased its fertility.

A farmer narrated: "*Hik hari Jo chawan ho ta jadhen jet Jo hamlo wadi wanje tho ta zarai zahar zabto Karin men nakam aahy, khuwamkhuwa hari 1500-3000 hari wadhik kharach kare tho"* (Chemical pesticides fail in case of extreme pest attack as well as we have to spend extra money to buy fertilizer to enhance soil fertility. A small pack of fertilizer or chemical pesticide cam cost 1500-3000 rupees which is not economical)

Farmers also complain about the cost of the chemical pesticides as the traditional methods of controlling pests and insects were not costly. On contrary, the chemical pesticides are expensive. A respondent narrated: *"Aho saheh ahi tahay jaraseem mar dawanan fasal ki paidawar ki behtar batayen tiwan par jaraseen mar dawyan ji qeemat paidawar ji heet hi heti ahi"* (It is true that pesticides improve the crop yield but the cost of the pesticides is double the amount of the yield).

5.3 Perception about Occupational Health Hazards

Farmers are of the view that they are not much aware about the use and benefit of protective measures for chemical pesticides. They prefer the guidance of pesticide seller about the use of pesticides and use them according to their convenience. Nevertheless, as a number of accidents and death happen in research area, they get the idea about the negative health impacts of the chemical pesticides. Despite the existence of health hazards, farmers prefer the use of chemical pesticides.

A farmer stated: "*Hik hari Jo chawan ho ta har chae Jo faido and nuqsan hondo aahy, je zarai zahar jet Khan Bachao kare tho ta wari sehat khy nuqsan die tho"* (everything has both positive and negative features. If pesticides secure crops from pest and insects, they impose health issues to human too)

5.4 Perception about traditional pesticides

Framers do not practice traditional methods for pest and insect control. They have shifted from conventional to chemical pesticide methods but still considered traditional methods as safe for humans and environment due to the use of organic and environment friendly products. On contrary, they are not satisfied from the economic results of traditional pesticides.

A farmer narrated: "*Hik hari Jo chawan huyo ta asan wat sutha Ozar hujan Aen asan khushal hujon ta asen pahanja tareeqa zarat khy tajeeh dendase"* (If we are well equipped with material and have better income then we would prefer the use of traditional pest control method but that is not the case in our area)

5.5 Perception about environment and pesticides

Farmers who use chemical pesticides do not much care about the pollution created through their pesticide usage and are least aware about the effects of pesticides on ecosystem. Mainly, they believe that the use of inorganic products have harmful effects on animals and they are much concerned about it.

Another farmer narrated: *"Hik bie hari Jo chawan Jo ta zarae zahar je istamal Je kare asna khy maal je wadhik sambhal Karni pawe thi"* (We all have cattle used for farming. Due to the use of chemical pesticides, we have to take extra care of them as their exposure to pesticides is lethal for cattle and other animals)

Besides animals, they believe that every crop has friendly insects which help in crop development and pest control naturally to some extent. The use of chemical pesticides is harmful for them.

5.6 Perception about the Benefits of pesticides

There is a local perception that insecticides and herbicides are main source of high yield. The farmers believe that their economy depends on the agriculture, if the seeds produced high yield and good grain then the farmer get more benefit. The vegetables are most cared for quality because of the edible crop, it should be of best quality. The vegetables are edible crop but farmer considered it as a cash crop in sense of sell cash money. The use of chemical pesticides in agriculture improve production and benefitted both the farmers and the selling companies.

A respondent narrated: *"Upat Jo matlab ta fasul men wadharo, zarae zahar je istamal je kare asan upat wadhik waran je qabil thiyon tha thori Zameen je tokre men wadhik upat ghanon tha, cho ta gand gah aen Jeet, keera fudal ji upat ty shaded asar kan tha. Zarae zahar Jo istmal fasul ji upat khy behtar kare tho Aen nuqsan kha bachae tho, en kare asan khy faido thie tho Aen mazdor Jo qeemat be bachi pawae thi, jadhen ta gad gah ji dawa Khan pehriyan asan mazdoran zaree gah khatam kanda huyase, so zarae zahar fasul je quality behtar kare tho"* (Productivity means input and output of the yield, so with the help of pesticides we are able to increase yield or to produce more crop on a small piece of land. Productivity of crops is severely reduced by the factors, like diseases, unwanted plant,

weed and insects, and pests. The use of pesticides has improved crop including control loosing of the features of yield in crops. In this way, we are able to increase profits, cut down the labor cost. Before the herbicides we were hiring the labors for losing the gross. The pesticides are used for saving the quality of crop).

Many farmers believe that pesticides are used to control many human diseases. Many pathogens (virus, bacteria, fungus) are disease agent and are transmitted through insects (vector) in the human beings as Malaria. Malaria is caused by the parasite plasmodium (microorganism) and depends on other organism for nutrition, so it is cause of the transmission in human body as like bite of mosquito or dengue fever is also transmitted by the mosquito due to virus. Similarly, scrub typhus caused by the bacteria is being transmitted to human by mites. Yellow fever also caused by mosquito vector. The pesticides help to prevent death and many kind of diseases. Pesticides are used to control several plant and human diseases.

Another respondent narrated: *"Sawan ji mosam men khuliyal jagh men tamam Ghana mashar aahin, zarae zahar je istamal je kare asan mahffoz aahiyon ghanan bemarion je kare Jen malaria bukhar Aen dengue Jo asar"* (In open places, there is immense mosquito attack in summer season. Due to pesticides, we become safe from many diseases caused by mosquitoes such as Malaria and Dengue).

The famers always store the grains for the next season. It includes grains as well as seeds for next season. Sometimes, harvesting crops are difficult to cultivate due to attack of the pest, insets, like rodents or molds. But storage of grain crop for the long period due to pesticides spry make it fresh, consumable and disease free. They believe that the pesticides get positive reflection in storage system of grain and enhances the life cycle of grain and dry fruits. Pesticides also be used against bee and ant allergic cause of insects.

A few farmers also consider pesticide as responsible for conservation of the environment. By the use of pesticides, farmers do not need afforestation. They are able to produce more crop in small piece of land and pesticides also kill the weeds which saves the soil deficient of nutrient. Similarly, herbicides are also used for controlling the weeds.

5.7 Theoretical Discourse

The analysis is aimed at delving the worldviews and factors shaping the perception of farmers under the economic liberty. Farmers who have used chemical pesticides and became economic prosperous deliberately ignore the negative impacts of inorganic pesticides for high crop yield. In theory, the Neoliberalism suggests free market concept that leads to individual liberation in economic terms and benefits with the lack of state intervention. Farmers believe that the pesticides contain harmful ingredients and chemicals but they are content with the satisfactory results of the pesticide use. Margaret Thatcher in 1981 has stated that it is a method to change the heart and soul. (Gershon, 2011)

Based on the findings of the research, the perception of the farmers have largely formed under the influence of pesticide seller who inform them about the benefits of pesticides. The farmer has been involved in chemical pesticide use to control different pests from the crops o the guidance of pesticide seller because they have limited knowledge about the appropriate use of pesticides and pest control. It is apparent that the criteria behind the decision of their use of chemical pesticide is high crop production. The understanding of the farmer about the pesticide derives from pesticide seller. They rely on the seller about the application of pesticides.

Chapter 6

IMPACTS OF PESTICIDES ON ENVIRONMENT

Pesticides are excessively used is agricultural fields. By increasing the use of pesticides, the crop protection also enhance the yield but result in many side effects of pesticides on environment and ecosystem. There are least number of the degradable pesticides, all pesticides and herbicides do not degrade in the environment quickly.

6.1 Impact on Environment

In agricultural landmass, there is a deterioration of environment due to increase and widespread use of plant protection chemical products. Pesticides are proved to be responsible factor of the decline in biodiversity. They can contaminate water, soil, land and living organisms. Herbicides are acutely toxic among pesticides but insecticides harm non-target organisms. (Carsten & Zaller, 2019)

In research area, about the ninety eight percent of pesticides are sprayed on crops. Similarly, ninety five percent of herbicides reaches a destination other than the targeted species or pest and their travel mediums are air, water and soil. Through these channels they move from one place to other and affect the ecosystem badly. The pesticides used are the main cause of decreasing the bio diversity of insect because the pesticides kill both vegetarian and non-vegetarian insects as they kill the insects and moth etc.

They are also pollinator agents and if they do not take part in pollination then farmer would be unable to produce fruit including the green vegetables. In this way, pesticides are major cause of global worming as well as air pollution. In high temperature, pesticides evaporate in warm area. They come to the surface level again with the help of snow, rain, and carried by the river, ground water and soil and finally become a part of chain of the ecosystem.

As the use of chemical pesticides has direct effects on environment due to excessive reliance of farmers on them. The environmental factor is considered as the major neglected factor in term of pesticide application and its consequences. Nevertheless, it is perceptible that farmers and pesticides sellers are aware of the environmental hazards of using

chemical pesticides. The pesticides companies have made it impossible to achieve high crop productivity without the use of chemical pesticides. The easily accessibility of the pesticides due to deregulation of the government, privatization of pesticide industry and free trade between various pesticides companies have make it easier for farmers to use pesticide and have adverse effects on environment.

6.1.2 Surface Water Contamination

Pesticides residues contaminate surface water in agricultural areas which is happened in variety of ways. The spraying or dropping of containers near water supply, rinsing spray equipment in water resource and using pesticides in windy condition has increased the chances of water contamination.

The pesticides spry or by using other medium a farmer use pesticides on crop or plants where raining in the area result in contamination of surface water with pesticide. Soil poison is also caused by the surface water contamination. Pesticides can also be spilled accidently on the land and its absorption reach to the water.

A respondent narrated*: "Hik dafe aaon parsan ware wah man hath dhota ta kuch minutes bad monkhy hathan men elergy thi"* (Once I washed hand in a nearby pond. After few minutes I got irritation in my hands).

6.1.3 Ground Water Contamination

The excessive use of toxic chemical pesticides is the major cause of water contamination. Chlorine is one of the most dangerous poison in pesticides, when get in contact with water it would become impossible to clean water in years. The ground water is used for drinking and household purposes. Therefore, many peoples are drinking impure water due to excessive use of pesticides. (Ahmad, Anzar, & Tariq, 2019)

In agricultural field of Larkana, the widespread use of pesticides has controlled the pest and insects attack to a larger extent whereas it is associated with several environmental changes. The ground water is found to be contaminated with the overuse of pesticide. This is caused due to the misuse of pesticides by farmers in their cotton fields.

A respondent narrated: *"Asan khy aksar fhumra thiyan tha Pani peean je kare cho Pani ji pipeline un ee Zameen man achy thi"* (We often get diarrhea by drinking water as water in our homes are supplied from nearby pipelines fitted in ground).

6.1.4 Soil Contamination

The major portion of the pesticides used in agriculture get absorbed in soil. The repeated use of pesticides aggravates the soil problems. Pesticides absorb in the soil change the bio composition of the soil and biomass which disturb the soil ecosystem and results in soil infertility. (Akhtar, Sengupta, & Chowdhury, 2009)

The use of pesticides in farms of Larkana pollute the soil badly due to the use of various kind of pesticides, insecticides and fungicides. All the toxic chemicals are directly absorbed by the land, so continuous use of such sort of chemical pesticides cause soil contamination. Currently, the farmers sow chemically treated seeds and many other plants diseases are controlled by spraying pesticides which affect the soil.

Many nematicides directly sprayed on soil which damages the micro-organism living in the soil. The pesticides contains carbon, nitrogen and phosphorous, it destroys carbon cycle of micro-organism including decomposers severely. There are many beneficial insects which are work for nutrition of the soil and are decomposer of the remains. Their presence is necessary for better production of the crop. Unfortunately, due to frequent use of the toxic chemical, the soil loses its matter and soil fertility is reduced.

A respondent narrated: *"Hik fasul Khan Poe Zameen ji zarkhazi ghatiji wanje thi, Poe hari wadhik khad and zarae dawaon istmal kare tho zarkhazi wadhin lae"* (After one season cultivation, the soil fertility become decreased. We have to use many fertilizers to increase its fertility).

There is a plant family which fixes the atmosphere as like each of the rose crop is working to fix nitrogen into soil, with help of biological nitrogen process of fixation, the nitrogen fixation is playing vital role in organic matter of soil including nutrition of the plants. But the severe use of methyl parathion kills the Rhizobium insect and bacteria, this insect play significant role to fix the nitrogen, so the farmers kill it through pesticides.

6.1.5 Impact of pesticides on Eco-friendly insects

The pesticides are a poison to kill various pests and insects which are rearing in the field area but each of the farmer wants to kill the harmful insect. Unfortunately, there is no pesticide available in market which kill only targeted insect, therefore, it is the only way to protect the crop from damage to kill all positive pests with negative insects otherwise the farmer could not prevent the damage of the crop.

Parasitoid Trichgramma is a male parasite which produces egg in female. There are many types of small beneficial insects which are destroyed by pesticides and almost two hundred sorts of harmful pests, so Trichogramma chilonis is one of them which control on stem borer in sugarcane crop. Especially in research area, trichogramma pest is used to control the stem borer in sugarcane. It is considered as the best treatment because this insect eats the eggs of harmful pests.

The host pest life limit is five to eight days. It attacks the crop from July to September. The trichogramma leaves their eggs inside the pest eggs. It is considered as the first nutrition of trichogramma larvae (*Sundhi*) in first satge of friendly insect then grow inside then come in second stage Pupae after that it moves to third stage adult then it leave the eggs of harmful pest. The host completely destroys in this period. Each sugar mill tries to increase the ratio of the insect for saving the crop quality and use trichogramma card in February in sugarcane crop.

6.2 Effects on Animal

The pesticides also affect the animals as livestock is interconnected with agriculture. They graze the grass and drink water from nearby ponds. After pesticide spraying, the grass is often eaten by the animal which severely impacts the animal digestive system. Such kind of pesticides cause bacterial and viral infection including genetic change among the animal and death. The dried crop is the main source of animal feed which is full of the toxic chemical. Pesticides are responsible of the decline of animal species in society.

6.2.1 Case Study

It is the case study of a farmer who have livestock used for food and agricultural purposes. His buffalo has died due to inorganic pesticide poisoning. A farmer sprayed pesticides on the field. His buffalo ate grass from the field later. The pesticide spraying did not only effect the animal life but also the farm economy of the farmer.

The respondent narrated: *"Zarai zahar jo fuharo Karin khan poe jadhen menhon zamen ty aayon ta aaon kon huyus na ta monkhy khbar hue ta bharsan ware goth waran joon ganiyon menhon mari wayon huyon, na ta aaon zahar je asar khy behatr tareqe san janan tho aen menhon khy zamen je wejho achan ee kon diyan han"* (I was not at the farm when my buffalo went to the farm after pesticide spraying. I remembered a similar incident of another village where many cattle died of the same reason. Therefore, I always try to keep away my cattle from the farm after the use of pesticides as it can affect their life).

In the research area, livestock is very important for the people because it is an important source of village economy. Farmers care animals as they care their own children. Chemical pesticide and using other inorganic things in the field are equally poisonous for the animals. Besides the benefits of pesticides as pest control, it has adverse impacts on livestock. The farmer in above mentioned case study has narrated an abortive experience of pesticides usage on his livestock due to several factors including lack of proper knowledge about the effects of chemicals and application. Loss of livestock due to chemical pesticides also has negative impact on the farm economy.

6.3 Effects on Aquatic Life

Farmers started the use of chemical to grow their food. They are entirely unaware about the effects of chemicals. No proper mechanism is being observed for the careful use of the chemicals. Pesticides are highly toxic for fish and other species and most dangerous for ecosystem. The modern chemicals as organophosphates would be observed eco-friendly as compare to past chemicals but its more toxic per application on the other hand it would be proved more dangerous for species. Herbicides used to prevent the growth of weeds similarly prevent photosynthesis and inhibiting the enzymes. Some pesticides are less

harmful for human including animals but they are still affecting fish and pollute ground water.

The toxic substances from the pesticides enter into the water sources through various routes including spillage, surface runoff, treated soil and other ways. The impact of pesticide poisoning on water species is categorized depending on the exposure period such as lethal or sub-lethal. The pesticides chemicals enter into the body of the animals through their skins, breathing gills, and dermal pores. The aquatic life consists of various animals including invertebrates, plants, microorganisms, fish, or amphibians. Pesticides effect all these animals directly or indirectly with chemical poisoning.

6.3.1 Case Study

The farmer of the research area also rely on fish selling and use fish as a source of food. The inorganic chemical pesticides are dangerous for aquatic life mainly for fish. A farmer told the researcher about the negative impacts of pesticide use on aquatic life. A pond nearby a farm was owned by a farmer and his maternal uncle. His uncle once washed the container of the pesticide in the pond after pesticide spraying in the field. Later, he threw the container in the pond. Due to the poison, all the fishes in the pond died.

The respondent narrated: *"Muhanjo mamo zarai zahar je asar khan waqif nahy ta zarai zahar wariyon shishiyon zindgi lae ketriyon nuqsankar aahen"* (My maternal uncle was not aware about the poisonous impacts of pesticides that the container of the pesticide was full of poison and harmful for all living things).

Fish are the majorly affected animal as they are directly affected by being fed on the chemical or drinking contaminated water. Pesticides contains many chemicals which are lethal for fish species. The proper disposal of pesticide container has been important for the life of humans as well as animals. The remains of pesticide chemicals in the container are highly dangerous for aquatic animals. In above mentioned case study, the improper disposal of pesticide containers has detrimental effects on fishes which illustrates the negative impact of chemical pesticides on animals.

6.4 Theoretical Discourse

The preeminent focus of the study is to explore the environmental consequences of chemical pesticides. The worldview of farmers about environment as an economic commodity leads to the destruction of ecosystem. The use of neoliberalism in the agricultural sector has increased the chemical burden on natural ecosystem. Pesticides based on chemical products have many environmental risk factors. Farmers of the research are predominantly focus on the production and protection of their crops while ignoring the potential harmful effects of pesticides on the environment implementing production sovereignty and free trade due to deregulation of government in pesticide industry. Consequently, water, soil, aquatic life and livestock is effected by the pesticides residues.

Similarly, Steffen has well documented the environmental framework in regards of pollution, habitat loss and climate change which mismatch with economic system as it focuses on economic growth and environmental crisis. (Jones & Stafford, 2021) The farmers of the research area consider environment as means of production and are less concerned about its conservation. They remain under the persistent fear of crop failure due to which they use chemical pesticides without analyzing the risk factor of pesticides to environmental components. The pesticide sellers sell pesticides to farmers by guiding about the benefits of pesticides for agriculture while ignoring the harmful effects on environment.

Chapter 7

IMPACTS OF PESTICIDES ON HUMAN HEALTH

7.1 Farmers and Pesticide Application

Majority of the respondents do not get any kind of training about the accurate and safe use of pesticides. The sales representatives guide farmers about some precautionary measure during the use of pesticides but no training session related to handling of pesticides and containers and awareness program is given to farmers in research area. The pesticides company representative entirely failed to arrange session on safe use of pesticides. Similarly, growers did not take interest for getting awareness about safe use of insecticides or herbicides.

Figure 5: Pesticide spraying by a farmer

(Source: Photo by Researcher)

They are interdependent on one another. Farmers imitate others in the use of pesticides. The precautionary and safety equipment including face masks, goggles, gloves or respirators are not used in research area. Some of the farmers do not wear proper clothes during spraying and use of pesticides which is highly harmful for their life and have deadly impacts on them.

7.2 Use of Pesticides and Human Health

In research area, numerous negative health effects have been associated with chemical pesticides which results in various categories of health ailments including gastrointestinal, neurological, respiratory and dermatological. The health issues often result in hospitalization or death depends on the type of exposure either occupational, accidental or intentional.

7.3 Ways of Exposure to Pesticide

Pesticide exposure occurs in many ways. Farmers of the research area are exposed to pesticides in agricultural setting for pest protection and treatment of crops as well as to store the agricultural product. The pesticides residues has become a part of the food which also put the health of people at risk. The human exposure to pesticides is divided into two categories each have different health impacts.

7.3.1 Occupational Exposure

It can occur through application and handling of the pesticides. In Larkana, majority of health issues among farmers who use pesticides are caused due to occupational exposure. The pesticide major effect is caused by the skin contact during mixing, disposing or cleaning of the equipment as protective tools are not used in the locale during pesticide use. The skin absorb the liquid formulation of the pesticide. Major health concerns are also faced by the locale farmers when spraying pesticides due to inhalation of the pesticide as respiratory exposure.

The farmers feel suffocation with the excessive use of pesticides which raises skin problem and allergy with the use of the insecticides spray. The farmer is least aware about health hazards but he/she focuses on the saving of crops, the farmer works on priority base in crop, when crops are attacked by pests and insects, the farmers do not care about their health. They consider most dangerous poisons for quick recovery. The farmers are working day and night at fields and are using various kind of pesticides, and herbicides for the purpose of high yield of good crop but they are entirely unaware about the impact of pesticides on their health. Due to less information, the pesticides are being used not

carefully by the growers without consideration of cautions of pesticides. The poisons pesticides contain are very harmful for health.

7.3.2 Non-occupational exposure

Many farm products including fruits and vegetables as well as water contains a variety of pesticide residues. Pesticide residues consists of any substance in food from the use of pesticide which is considered to be the toxic. Pesticide residues are the result of pesticide application, storage of agricultural products and can be found in fruits, grain, water and vegetables. (Maipas, Kotampasi, & Hens, 2016) The washing and peeling of the fruit and vegetables cannot remove the pesticide residues. It includes contact with contaminated food and water. The clothes used while spraying pesticides are contaminated and are kept at home after pesticide use which have become a major health hazard for children and women. Similarly, the pesticide containers are not disposed properly and easily found at open places in farm which results in severe health effects.

Figure 6: Pesticide container at farm side

(Source: Photo by Researcher)

Women who work with their male family members also get effected with the harmful impacts of pesticides. The infants and growing children as well as nursing mothers are at high risk of health outcomes from pesticide exposure.

A farmer narrated: *"muhanji zal monsan gad zameen jo kam kandi aahy, asan sabzi pokhinda aahiyon, hid dafe aaon zarai zahar jo foharo kayo aen muhanji zal pet san zameen men kam pae kare ho ochito bemar thi pae aen hun jo bar zaya thi wayo"* (My wife works with me in the farm. We have grown vegetables. Once I sprayed pesticide on vegetables. After that, my wife went to the farm. She was pregnant at that time. She got ill and had miscarriage).

7.4 Short term effects of pesticides on human body

The many respondents shared opinion about the short-term pesticides. The main reactions are usually observed on limited external area of body that have exposed to the chemical pesticide. A short exposure to chemical pesticide can result in acute poisoning. Such sort poison affect through skin absorption, breathe inhalation and eye irritation. Symptoms of poisoning would appear constantly forty-eight hours. It is may be knowing as inflammation of skin, rashes or blisters is common. Some other diseases are being observed such as nausea, vomiting, diarrhea, extreme weakness and loss of consciousness.

7.5 Long Term Effects of Pesticides

Most of the respondents were in continual use of pesticides but limited exposure to pesticides do not show immediate effects. Pesticides exposure has later serious health impacts. When patience health is critical condition because of low dose of the pesticides accumulated in human body that is cause of the serious harm of health in future. In this way chemical pesticides may be playing vital role to disturb or damage the body functioning and metabolism. Exposure to chemical pesticides over a long time can cause obesity, cancer, early puberty, diabetes, and urinary tract diseases. Moreover, neurological diseases including memory loss, insomnia and visual impairment are one of the major long term effect of pesticides.

7.6 Neurological Effects

The chemical agents of the pesticides has caused damage to normal brain functioning. Framers who work constantly in farms and use pesticides for a long periods have difficulty in attention, concentration, psychomotricity, language and have short-term memory issues with high frequency of headaches and insomnia.

A respondent respondent: "*Aaon na tho janan ta zarai zahar ya chemical je fohare Karin bad ba khan char denhen mathe mrn sor rahe tho"* (I have no idea whether it is the smell of the pesticide or chemical due to which I suffer from persistent headache for 3-4 days after pesticide spraying).

7.7 Cancer

Pesticides, public health and agriculture are associated with a growing risk of cancer for people applying pesticides. The active ingredients of the pesticides have chemical composition increasing the chances of various types of cancers in farmers. (Alavanja & Ross, 2013) Various kinds of cancers are caused by pesticides poisoning mainly skin cancer to the farmers and brain and breast cancers to women and children. Pesticide exposure has the potential ability to act as a tumor promotor and increase the risk of breast cancer and cancer related mortality in children which is mainly a consequence of parental, prenatal, and residential exposure to pesticide. Skin cancer is one of the leading cause of death in research area. Many farmers have experienced contact with the pesticides during spraying or handling of the chemical which results in mortality.

7.7.1 Case Study

It is the case study of a farmer who was suffering from skin cancer. He was thirty six years old. He had been worked in a farm and used pesticides to protect crops and vegetables from pests and insects. It was informed by other farmers that one day, he was spraying insecticide on the vegetables to control pest attack. He accidently touched his hands on the body and got contact with insecticide. He suddenly washed his hands in a near pond of water. Initially, he felt irritation, burning sensation, rashes and later got blisters. He got

treatment from a nearby clinic. Later, he developed melanoma which is a kind of skin cancer.

A respondent narrated: "*Hun khy tamam ghano sor wadhi wayo jadhen hun ji bemari hath khan saje jism men fehalji wayo aen ho chamiri jo ilaj karai karai bin salan men mari wayo aen hun jo moot khan poe harin men khof peda kayo"* (He had been in extreme pain when the diseases has spread from his hand to other body parts. After fighting and treating this skin conditions, he died two years ago. The deaths of farmers has caused fear among other farmers).

The extensive and incautious use of chemical pesticides is fatal for human life. Chemical pesticides are not only used for large scale farms but vegetables are also grow by chemical pesticides and spraying. Insecticides are specifically used for vegetables to control pests and insects and are dangerous for the health of public. Chemical pesticides while spraying spread in the field and are dangerous for the lives of farmers. Due to dearth of proper safety equipment and first aid knowledge, the application of chemical pesticides has fatalistic impact on human health.

7.8 Mortality

Increased mortality cases caused by pesticides use has been a severe health problem. According to World Health Organization, one million deaths due to pesticide poisoning occur annually. The number of deaths are higher in developing countries where majority cases are of farmers. (Langley & Mort, 2012)

In research area, deaths due to accidental pesticide poisoning has become a major farmer health issue. The unsafe use of pesticides during occupational activities has increased the risk of mortality in farmers. It was observed that farmers do not follow any protective measures during handling and mixing of pesticides in containers before application which increases the risk of poisoning and death.

A respondent narrated: "*Guzaral kuch salan men khetra ee Ghana hari guzare waya aahen zarai zahar je kare, par asan khy khabar ee nahy ta zarai zahar je asar thiyan khan poe manhon khy ken bachae saghije"* (In previous years, many farmers have lost their lives due

to pesticides. We do not have any information and awareness about emergency management in case of pesticide poisoning).

The doctors interviewed during fieldwork reported the few occupational death cases due to pesticide application as well as mild illness symptoms in farmers. They considered the use of pesticides in research area as fatal for farmers due to lack of protective measures while handling pesticides.

A doctor narrated: *"Aam tor ty hari ehri halat men doctors San mashora na tha kan un shae khy normal samjhan tha, jadhen marez ji sanjedha halat thie thi ta Poe bachi natho saghe, unkhy zarae zahar wathi wanje"* (Usually farmers do not consult doctors in case of mild symptoms. They consider it normal. On contrary, in serious cases, the patient is not able to survive due to pesticide poisoning)

Figure 7: Handling of Pesticides by farmers

(Source: Photo by Researcher)

7.8.1 Case Study

It is the case study of a farmer who has died due to the use of chemical pesticide. He was forty one years old. He was married and father of four children. One of a farmers who is a

relative of the deceased farmer as well as the respondent of the researcher informed about the incident. During the time of pesticide spraying, the chief of the village announced the collective spraying of the whole field. The pesticide spraying is locally called as “Shir”. The farmer who has lost his life was spraying pyodine pesticide. He was not wearing any protective equipment. During spraying, he touched his hands on face and the pesticide poison went in the body through breathing. Suddenly, he fainted and fell down on the ground.

A respondent narrated: *“Hik hari budhayo ta jedhen hari fohari kayal zameen ware pani san munhan dhoto ta behosh thi pat ty kiree payo ta unkhy hospital khani wayasen par badqismati san hospital panch kilmetre pare hujan kare ho guzare wayo”* (When he lost his senses and fell on the ground, we had tried to spray water on his face but he did not respond. After that, we took him to the hospital. As the village areas are not much privileged, the distance from the village to the hospital was five kilometers. Unfortunately, he died on the way to the hospital).

Another respondent recounted: *“Doctor hun je fotigi jo sabab zarai zahar budhayo, un denhen asan khy khabar pae ta zarai zahar zindgi lae hajikar aahy”* (Doctor has informed us that the cause of his death was pesticide poison. At that day, we got familiar with the deadly effects of pesticides that they can take life of a person).

Chemical fertilizers and pesticides have become part of agriculture. Pesticides used by farmers have become necessary in their fields because that give crops production quick and in large quantity. A farmer has lost his life due to improper handling of the pesticide and accidental contact with it. The pesticides has deadly impacts on the health of farmers and surrounding population. In this case study, the researcher has collected a true story about a farmer how his life was ended by chemical pesticide. The farmers are facing several health effects of the pesticides but they are more attracted towards getting economic benefits. The pesticides sellers persuade farmers about the benefits of the pesticides more than the adverse effects to become more profitable.

7.9 Theoretical Discourse

In research area, the farmers are negligible about their health under the notion of getting high crop yield. Farmers freely get inorganic pesticides from markets and use according to their choices. Therefore, the major analysis has focused on the objective of the impacts of pesticides on human health by relating neoliberal economic policies. Neoliberalism is chiefly a system of economic practices which emphasizes free market and lack of government intervention in the economy which has significant health impacts on public in several fields. The deregulation of the government and free trade between farmers and pesticides companies has exploited the health of the farmers.

According to Sue Macgregor, health is the biggest sector which has impacted after the first implementation of the neoliberal policies. Lindheim argued that the privatization of the industries has increases the sense of competition which stresses the industries in economic terms. Consequently, it has negative impact on public health as companies do not take any responsibility for the damage they cause. (Macgregor, 2001) Likewise, the findings of the study also illustrate adverse impacts with mild to serious health ailments as well as mortality among farmers who use pesticides under the sense of getting economic benefits and competition of pesticide companies without regulation of government.

CHAPTER 8

SUMMARY, CONCLUSION & RECOMMENDATIONS

8.1 Summary

This study was focused on exploring the comprehensive perception and beliefs of farmers about inorganic products used in agriculture. It examined the types and use of pesticides in research area including the rationale behind the preference of chemical pesticide as well how pesticides are applied in field. Moreover, it was aimed at analyzing the impacts of chemical pesticides on farmer's health and environment.

The locale of the research was *Larkana* district of Sindh province. Thirty farmers who use chemical pesticides, five doctors and five pesticide sellers were selected as research respondents through purposive sampling. Socio-economic census was used to get demographic characteristics of households. Qualitative research methods including participant observation, in-depth interviews, focus group discussion were used to carry get in-depth knowledge about research questions.

The farmers of research area prefer the use of chemical pesticides due to several reasons. The usage of inorganic pesticides is based on the perception and belief of farmers about pesticide use, application and consequences. Their perception about pesticide utilization is influenced by their economic conditions, demographic traits, pressure of farming community and pesticide market. Many young farmers have adopted new methods and technologies of farming. The education of the farmers also play a crucial role in determining their worldview about pesticides. The role of pesticide seller and companies is significant in perception building process of farmers.

Majority of the farmers also adopted modern agricultural methods under the influence of their farming community. The perception of farmers about the inorganic pesticides is varied despite the fact that they all use chemical pesticides to protect their crops from pests and insects attack. In research area, a large segment of farmer's population have positive

perception about the use of chemical pesticides. They believe that insecticides and herbicides are main source of high yield. Productivity of crops is severely reduced by the factors, like diseases, unwanted plant, weed and insects, and pests. The use of pesticides has improved crop including control loosing of the features of yield in crops. Due to insecticides they are able to reduce the labor and improve the quality of crop. Many farmers believe that pesticides are used to control many human diseases including yellow fever and Malaria. Pesticides also make the storage of grain possible and the storage of grain crop for the long period due to pesticides spry make it fresh, consumable and disease free. Beside the positive perception, a few of the farmers also have negative belief about the chemical pesticide based on their experience of the use of these pesticides. Farmers believe they are not much aware about the use and benefit of protective measures for chemical pesticides. They do not practice traditional methods for pest and insect control.

In research setting, mainly three or four famous types of pesticides are used in agriculture such as Vartako and Diammonium Phosphorus (DAP). Major crops of the area cotton and rice crop which are cultivated on different areas. The farmers are least aware about the pest house and its rearing stages. There are many reasons for not getting expected result from the pesticides because of the various kind of pest exists in agriculture. The use of pesticides has improved crop including control loosing of the features of yield in crops. In this way, the farmers are able to increase profits, cut down the labor cost. The pesticide get positive reflection in storage system of grain and enhances the life cycle of grain and dry fruits. Pesticides also be used against bee and ant allergic cause of insects.

The inorganic pesticides has positive points as well as many negative side effects on environment and ecosystem. The pesticides spry or by using other medium a farmer use pesticides on crop or plants where raining in the area result in contamination of surface water with pesticide. Many pesticides are directly sprayed on soil which damages the micro-organism living in the soil. The pesticides also affect the animals as livestock is interconnected with agriculture. The toxic substances from the pesticides enter into the water sources through various routes including spillage, surface runoff, treated soil and other ways.

Several negative health effects have been associated with chemical pesticides which results in various categories of health ailments including gastrointestinal, neurological, respiratory and dermatological. The health issues often result in hospitalization or death depends on the type of exposure either occupational, accidental or intentional. The farmers feel suffocation with the excessive use of pesticides which raises skin problem and allergy with the use of the insecticides spray. The farmer is least aware about health hazards but they focus on the saving of crops, the farmer works on priority base in crop, when crops are attacked by pests and insects, the farmers do not care about their health.

8.2 Conclusion

Farmers of Larkana district use chemical pesticides to grow their food. They are partially aware about the effects of chemicals. No proper mechanism is being observed for the careful use of the chemicals. Pesticides are highly toxic for human as well animals health including fish and other species and most dangerous for ecosystem. Farmers have developed their understanding of chemical agricultural products under the influence of pesticide companies and the need for high crop productivity. There is a dearth of proper knowledge about the application, handling and effects of chemical pesticides among the farmers.

Currently, every farmer has shifted from traditional pest control method to inorganic methods and are solely dependent on the modern agriculture techniques and pesticides. The traditional seed varieties have vanished gradually. Hybrid seeds have less resistance capacity from attack of various worms in crop. Similarly, farmer are less educated with no awareness of pest preventive measure or traditional controlling techniques. People are under the fear to damage crop and not getting high yield, so they prefers to adopt pesticides in field without calculating the negative impacts of pesticides on soil and other species.

8.3 Recommendations

- By considering the hazards of pesticides on human life, the pesticide companies should mention the appropriate or safe amount of pesticide on the containers to be used with all possible health hazards of pesticides.

- Pesticide companies should also give a leaflet with pesticides to guide about proper handling, precautionary measures and disposal ways of pesticides.

- Based on the findings of the study, the educational and training programs for farmers should be planned to make them knowledgeable about chemical pesticides, their usage and to adopt safety measures.

- Farmers must be aware about the harmful effects of pesticides on human health.

- Protective measures and equipment should be provided to the farmers to avoid health hazards.

- Ensure the use of proper pesticide storage and disposal of pesticide containers to avoid pesticide contamination in environment.

- For the conservation of ecosystem, the effects of chemical pesticides on environmental factors including soil, water and animals should be evaluated.

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ANNEXURE

Interviews from farmers

1. How do you select any pesticides/seeds for your field?
2. What is impact of pesticides impact your economy?
3. Have you experienced any health and environmental impact of pesticides?
4. What is the reason of using pesticides?
5. Do you know organic agriculture techniques which get high yield?
6. What are the varieties of pesticides use in the agriculture?
7. Which crop is needing most pesticides for growing fast?
8. What are the varieties of pesticides use for high yield?
9. How many varieties pest control pesticides in crop?
10. Which herbicides are you using in crop?
11. Did you get training safety use of pesticides?
12. Do you know time and amount of using pesticides?
13. Do you know which pesticides use in medium of spray and sow in crop?
14. Which season crop get much number of pesticides?
15. Do you know the pesticides killed also non targeted pest?
16. Do you know the pesticides killed environmental friend pest?
17. Have you experienced impact of pesticides in field?
18. Do you know the pesticides lose the fertile power of field?
19. How many times are using spray each crop?

20. Do you adopt safety measure during using pesticides in field?
21. Do you have knowledge that pesticides are hazards for your health?
22. Have you realized breathing and skin symptoms after using pesticides?
23. Have you felt head or skin crash during using the pesticide?
24. Have you any effect of pesticides on your field fish form?
25. Are you using hybrid seed of vegetables?
26. Do you know hybrid seeds are main cause of using pesticides?
27. How many varieties of the sprays for using vegetable grow fast?
28. Which most reliable spray for your crop?
29. Did you compare of hybrid and local seeds expenses amount including production?

Interviews from seller of pesticides

1. Are you following legal & scientific protocols during selling your product?
2. Are you confirming to farmer that your product effective geographical and ecological?
3. How many companies' products are you selling?
4. Which company is most familiar in this area?
5. How many varieties of pesticides are you selling?
6. Did you get training from pesticides companies?
7. Do you have guideline of safety use of pesticides by the company?
8. Are you guiding to farmers for proper use of pesticides?
9. Did you arrange seminars for farmers awareness?
10. Are you informing to farmers the pesticide is a poison?

11. Are you guiding to farmers safer usage of pesticides?
12. which pesticides company is most famous?
13. What are the well-known pesticides used for cash crop?
14. What are pesticides for vegetable crop?
15. Is there any difference for hybrid and local seed in sense of expenses/production?
16. Do you inform to farmers the side effects of pesticides?
17. Do you know impact of pesticides on farmer health?
18. Do you get aware the end user for wastage of pesticides?
19. Is the company provide safety stuffs for using pesticides?
20. Do you provide modern tools for using pesticides?
21. Are they getting precaution of safety use by the company?
22. If yes than how you transfer this information towards farmers?
23. Are you sharing information danger of the pesticides?
24. Are prohibiting the user the over use of the pesticides?
25. Are you aware the farmers to misuse of the pesticides?
26. Is any company prevail any campaign for safe and proper use of pesticides?

Interviews from Doctors

1. What is medical perspective of using chemical pesticides?
2. What are impacts of pesticides on human health?
3. How pesticides effect on human health?
4. What are the varieties of pesticides cause of diseases?
5. Which pesticides is most dangerous for health?
6. Which are major diseases being create by the use of pesticides?

7. Which are pesticides cause of breast cancer?
8. Which are the pesticides effects on stomach?
9. Which pesticide is become cause of the skin crash?
10. How a new born baby absorb the pesticides?
11. Which pesticides inhaled by the farmer?
12. How pesticides effect animals?

Socio-economic Census Form

S. No	Name	Age	Gender	Education	Occupation	Monthly/ Seasonal Income	Marital Status	Family Member	Chemical Pesticide use